

# The Mining Journal,

## RAILWAY AND COMMERCIAL GAZETTE:

FORMING A COMPLETE RECORD OF THE PROCEEDINGS OF ALL PUBLIC COMPANIES.

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### Original Correspondence.

#### UNIONISM.

Unionism is just now upon its trial. For months, if not for years past its paid agents and emissaries have been sent into the principal centres of manufacturing industry, spreading discord between masters and men, rendering employees discontented with their lot, and inciting them to strike for an advance of wages. What matter to these agents that hitherto the most amicable and kindly feeling existed between employer and employed—that the men were satisfied with a fair day's wage for a fair day's work, or that the inevitable result of strikes is to drive much of the manufacturing trade and industry of the country to Continental and other shores. So long as the funds of the Union will support these paid firebrands in ease and affluence the manifest evil results of a strike are of little or no consequence, and it matters not that once happy and contented workmen with their wives and families are reduced to a state of semi-starvation, or compelled to emigrate to other shores in search of work, and it may be to there endure hardships of which on their own native soil they can have no conception.

But Unionism, as we have before said, is now on its trial; its executive and paid advocates are arraigned before the public bar, charged in having used language calculated to cause a breach of the peace, and to have used other means which have led to most disastrous results. That the indictment can be sustained is self-evident from the fact that in Sunderland, Birmingham, Newcastle, Gateshead, and other large centres of manufactures, the men are in open arms against their employers, having left off work and resorted to strikes, not only for an advance of wages, but also for shortening the hours of labour; whilst almost throughout the whole of the important coal district of South Wales the colliers are idle, trade in many branches stagnant, and commerce diverted from its legitimate channels; and all this for the paltry matter of a shilling in the pound rise of wages. Not only so; idle mobs are always more or less dangerous mobs, open acts of violence are always apprehended, and if the reports which have appeared in the various local prints are correct, it is evident that the same Broadhead principles are at work in the workshops, and that the same evil and pernicious spirit as perpetrated dastardly acts on previous occasions only lies dormant, awaiting favourable opportunities for development and mischief. And is it not strange when these things are considered—when, too, Unionism has failed in every essential feature for which it was originally professedly established—how it has called forth the most antagonistic feelings—broken up thousands of once happy and prosperous homes—is it not strange, we ask, that under such circumstances as these it has still such a hold upon the hard-working and industrial classes, that every week large sums of money flow into the coffers of the executive, and that to-day Unionism is, numerically speaking, stronger than ever, its vicious principles advocated with bolder effrontery by its paid agents, strikes defended with greater persistency, and the men themselves the more ready tools and the easier prey than during any former period of its history?

Unionism having obtained this strong hold in the ranks of the working classes—having spread its meshes into almost every department of commerce—the evil effects resulting therefrom are most difficult to be dealt with, and its eradication a problem which might well perplex and puzzle the brain of the most astute reformer or social economist. The Legislature itself, by continually pampering to the working classes, has done much to foster this evil tendency of resisting the legitimate claims of the employer, and inciting the operatives to strike upon a whisper of any encroachment on the domains of labour. Two sessions since the Parliament of our land passed an Act legalising the funds of these Trades Unions. In itself that was an Act to which no exception could be taken, provided those funds were devoted to their legitimate use—relief to the members in time of sickness and distress; but is it not evident that the executive of these Unions have taken advantage of this apparent parliamentary sanction, and that indirectly the legalising of the laws of the societies by the Legislature has done much to strengthen the Unions most materially in other respects. Whilst Unionism is thus countenanced, how can its evil tendencies and results be successfully combated? Already it is declared illegal to combine together for the purpose of preventing a workman from following the bent of his own inclination, or to endeavour to molest him in following his occupation, and any trade act of violence or intimidation is visited with the most severe penalties of the law. But how can the law reach or punish that insidious evil teaching in the workshop which sternly forbids a workman, however able or industrious, from doing more work than the lazy drone? How can the law reach those who openly advocate strikes for the most trivial matters, and who succeed by preconcerted arrangement in the turnout of thousands and thousands of operatives and colliers for so small an advantage as a 5 per cent. rise in time of commercial depression, and who thus ruin the homes of previously well-to-do artisans and mechanics? To our mind the law is altogether powerless in these respects, and it is only by appealing to the common sense and the unbiased judgment of the working classes, through the medium of the press, that the evils of Unionism can be pointed out, and its pernicious influence and effects checked and overthrown.

But Unionism is on its trial in more respects than one. It has long since been condemned by the united voice of the manufacturing and commercial interests of the country, and our manufacturers have no greater difficulty to grapple with than the continual demands and the aggressions made by their workmen, incited thereto by the executive of the various Unions. But the very essence of Unionism is now undergoing a trial of no mean magnitude. It has so many strikes on hand in various parts of the country that its funds are called upon to bear a strain which but seldom occurs. It has been calculated that at present there are at least 30,000 men in various departments of trade and commerce on strike, and on the average 10s. per week per man is the sum promised by the executive so long as the strike shall last; should such be the approximate, a sum of 15,000l. per week would be required to meet the claims of the men, and at such a rate the funds of Unionism would soon utterly fail. And should not this single fact induce reflection on the part of the operatives and colliers now on strike? We are informed that in South Wales the colliers there, instead of the 10s. promised, received but 1s. 9d. per head during the first week, and that this was doled out to them

with far greater reluctance than the pauper's out-door relief. It is evident, then, that the men by relying on the Union funds for support in time of strike are leaning upon a very weak and broken reed. The greatest trial which Unionism has to withstand is its own inherent weakness, and inability to fulfil the pledges of its executive in time of emergency. In this respect we feel convinced it must utterly fail, and if we could only induce the working classes to reflect upon these things, and to remember that when on its trial Unionism is utterly unable to defend itself or carry out its pledges, it would receive such a blow as would render it prostrate, and which would take a long time before it could again assume its present gigantic proportions, to the serious detriment of the whole commercial and manufacturing interests of the kingdom.

#### ACCIDENTAL DEATH ASSURANCE.

SIR,—The question of accidental death assurance for workmen is one of the greatest importance; I do not mean for miners alone, but for every man who wishes to make some provision in case of accidental death, but is unable to prepay an annual payment of from 1l. to 5l. It occurs to me that if Government were to take it in hand, they could, by the machinery of the Post Office, do it without almost any trouble thus:—Suppose a weekly payment of 3d. to insure a sum of 100l. in case of accidental death: the man wishing to be insured might go to the nearest post office, and get a book or postal card, as he now does for the Savings Bank, clap a 3d. stamp upon the first page, and the postmaster's date-stamp (half on the book and half on the stamp), would be sufficient acknowledgment; and if the person insured was accidentally killed during the first eight days thereafter, then his representatives would get 100l. If any person insured failed to put on a fresh stamp any week, he would not be insured for that week, but he might resume payment at any time. Supposing anyone wanted to prepay for a month, a 1s. stamp would be put on, and so on.

I submit that there could be nothing more simple than this; there would be no bookkeeping, no possibility of any error; all that requires to be done is done by the Post Office official stamping the book, which would be the authority for payment of the sum assured. It would be a fair and legitimate scheme for Government to entertain. It would do an immense amount of good, and they have facilities for doing it which no company or society could. A COALMASTER.

#### ASSURANCE OF MINERS' LIVES.

SIR,—I have read with much interest the article in the Supplement to last week's Journal concerning the assurance of miners' lives, and was gratified to learn that by so small a payment as 1s. per week the widows and children of deceased miners can be so well provided for, but I cannot exactly understand that it proves that the proposition of a compulsory tax upon coal to raise the fund would be at all objectionable, and it would certainly be the readiest mode of raising the money. I believe it is estimated that there are between 300,000 and 400,000 working coal miners in this country; and taking the highest number, the contribution of 1s. per week would give but 20,000l. From the success which has attended the working of the benefit system in South Yorkshire, it is justifiable to assume that 20,000l. would be ample to raise, as the casualties in South Yorkshire are fully equal to those in other districts. If every man subscribed it would be all well, but as a matter of fact not more than two out of every three can be induced to do so, and those who fail to subscribe are often the men who are most required to provide, because they have, perhaps, large families to support, which keeps them poor. With the South Yorkshire system, then, alone to rely upon, a large proportion of widows and children would necessarily be left unprotected for, and it is for these especially that provision should be made.

Taking the annual get of coal at only 108,000,000 tons, and it is really considerably higher than this, a tax of one-eighth of a penny per ton would give upwards of 56,000l. per annum, or nearly thrice the amount which, according to the South Yorkshire figures, would be wanted. Now, such a tax would not be felt at all by the coal-owners, for upon a colliery raising 1000 tons a day it would scarcely amount to 150l. a year, and beside that it would relieve the coalowners of the responsibility they now so often undertake voluntarily of supporting the widows and orphans of men who have lost their lives in their employ. It may be asked why if 20,000l. only covers the estimate upon the South Yorkshire scale, 56,000l. should be raised? The reply is simple enough. Any actuary will tell you that for 1s. per week the benefits promised cannot be permanently paid, and there must, therefore, be a diminution of them whenever it happens that the progress of the society becomes stationary. In other words, the contributions of a larger number of new members will be required to provide for the payments to be made to the representatives of a smaller number of members falling in. The reason of the success in South Yorkshire is, I maintain, not because the system is good, but because the men earn very large wages, and are, as a rule, a more intelligent and thrifty class of men than miners generally.

June 20.

K. T.

#### IMPORTANT DISCOVERY OF COAL AND IRON.

SIR,—Conversing with a friend in Carlisle on geological subjects, I was informed that Mr. J. R. Rae, of Rayson Hall, had found some hematite iron on his estate, about 4 miles east from Longwathby, on the extension of the Midland Railway. Desirous of introducing every new geological and mineralogical discovery on my revised geological maps, which I am preparing for almost immediate publication, I communicated my wishes to Mr. Rae, who kindly invited me to pay a visit to Rayson Hall, informing me at the same time that there appeared evidence of coal also being found there. I was, of course, very anxious to have proof of this, and at my suggestion a trial first was made in the centre of a field of such dimension as would set at rest the doubt, doing away with the cost and trouble of boring, and being more satisfactory. The pit was dug to the depth of 4 ft. At 2 ft. from the surface we touched coal, and we left off with the opinion of having won a most valuable seam. After 40 years experience in geological and mineralogical research, I have never met with a more promising extension to the duration of our coal fields. To investigate well is the first duty, and to relate the truth is the duty of all; every one imagines himself to be free of prejudices; but the geologist in pursuing his investigation is imperatively called upon never to for-

get that the stony rocks themselves will bear testimony against him. So much for the coal. There seem to be no limit to the indications of ore; but no good opening has yet been made, nor do I advise this to be done until the crops are off the ground. However, from an analysis of *not the best specimen*, it proves of superior quality, and is entirely free from sulphate of barytes, a most objectionable alloy in much good hematite in Scotland. I have found also upon the estate fire-clay and argillaceous or clayband ironstone of good quality.

As this discovery may be one of great importance, not only to your readers but also to the nation at large, as concerns the durability of our coal, and not having seen it even mentioned, although other geologists have passed over this region of the Penine chain, by giving my letter a space in your extensively circulated paper you will oblige,

Botherby, June 19. J. A. KNIFE.  
P.S.—I have suggested further trials, and it will afford me much pleasure to communicate, at a future opportunity, the result of them.

#### IRON-SMELTING—THE FERRIE FURNACE.

SIR,—Confessing at once not only my inability but a want of inclination to enter into a newspaper controversy, I am reluctantly compelled, in fairness to your Glasgow Correspondent, and also in justice to myself, to reply to his letter on this subject which appeared in the Supplement to the Journal of June 10. I shall also, with your permission, anon refer to the irritable manifestation of "Smelter," in the same issue, on the same subject, who, by the way, vouchsafes his protecting hand to your Correspondent, which seems to me quite as uncalled for as it is unnecessary, your correspondent being perfectly able to "fuse" his own opponent without the over zealous intervention of "Smelter," whose blast on the occasion was hardly equal to the task.

In *limine*, let me assure your Correspondent that nothing was further from my intention than to offer offence, or even the semblance of it, in the independent discharge of his duties to your readers—duties which he has rendered at all times fairly and well; but when perusing the letter in the Journal which he quoted from the *Glasgow Herald* I thought it unfair that the course of a searching enquiry into the merits or demerits of the Ferrie process should be thus assailed by the partial quotation referred to; for the day following its appearance in the local press there also appeared another letter, bearing very pertinently on the same subject, and which he did not see fit to quote or refer to in his letter to you. I am glad, however, to observe that any remarks I may have made, as assuredly they were intended, applied only to the author of the quoted letter, and not to your correspondent, as his protesting friend "Smelter," who fails to see any difference, would have him to believe. I shall refer by-and-by to his subsequent remarks on the subject of furnace altitudes, meanwhile I beg your attention to the *whole tenor* of your correspondent "Smelter's" letter.

I cannot imagine why "Smelter" should hurl a taunting and spiteful paragraph at the patentee, or those who believe in the advantages of his new process, in his reply to the remarks of one whose only object in noting the quoted letter at all was to elicit practical suggestions or other pertinent information on the subject. What on earth have I to do with, or what conceivable connection exists between, a penny-a-liner and a practical ironmaster I know not. My "mechanical reading" fails to supply me with materials for such a vocation, and there is no more connection between the two than between a scribe and a "smelter." Surely, then, the references of "Smelter" on this point are quite *malapropos*. He cannot but be aware of what almost everyone connected with the pig-iron trade in Scotland feels—or, at least to my mind, ought to feel—that we have been so long accustomed to trudge in a beaten hereditary track, that any new and feasible innovation in this branch of commerce would doubtless be hailed with no little satisfaction by the members of the fourth profession; for, as they are well aware, since Neilson's invention of the hot-blast, in 1824, now 47 years ago, as a trade we have not kept pace with the advancing progress of other branches of industry, or with the age. We ought, therefore, the more readily to overlook and excuse any excess of zeal—if there have been any—in heralding in the local press what Mr. Hunter, Coltness, says "must revolutionise the Scotch iron trade." We ought, I think, rather to feel grateful for any compliments which may be paid to any member of the trade for what that member may have achieved, however little the achievement may be, for pig-iron advances are, like heavenly bodies, announced unfrequently in 100 years.

The belief that Scotland had been particularly favoured in its excellent smelting coals that required no coking, and its rich and pure black and clayband ironstone, are, no doubt, things "devoutly to be wished for," but let me sadly assure congratulating "Smelter" that, with the exception of a few thin seams of a special coal, the Scotch coals verily "require no coking," for they will not coke at all—not, at least, to yield anything like a profitable return to the ironmaster; and I fear his happy reference to the "rich and pure black and clayband ironstones" may now be regarded as things of the past to all practical purposes. Under such bereavements, we can only dream of the "colossal fortunes" in the far distance, which the poet tells us lends so much "enchantment to the view." But what of all this? What has this to do with the subject matter of my former letter—the altitude of hot-blast furnaces, and the best and the cheapest mode of making pig-iron? If you search my former communication from beginning to end you will not find the merest reference to these irrelevantly introduced "gifts of nature" which "Smelter" has seen fit to line out your columns with. Many of our "colossal fortunes" have been more the freaks than the gifts of nature. The foundation of not a few of those stolid edifices sprung into existence when the "rich and pure black and clayband ironstones" slept in comparative undisturbed rest, in the happy times when royalty was nominal, when the labour market could be possessed more cheaply than at the present day, things now, alas! of the past. These facts, not "beliefs swept away," require us to do more than stand meekly aside, hoping against hope for a speedy return of that "new faith" which shall restore to us those "particularly favoured" treasures which "Smelter" speaks of, notwithstanding "the reputation of being particularly watchful of and opposed to aggression on the part of claimants to patent right."

It is a perfectly futile argument for "Smelter" to say (indeed, his premises conclusively show the utter fallacy of his conclusions) that because none of the Gartsherrie furnaces formerly raised from 4 ft. or thereabout, to a height somewhere about 60 ft. "have been re-



duced" from that height, telling us with a *smile* at the same time that "this company are not reputed as being likely to carry on their operations to a disadvantage when they know of a better plan, their adherence to the high furnaces indicating, at least, their faith in them." I accept the statement he thus advances, although it is, perhaps, unfair that we should single out Gartscherrie for mere purposes of demonstration. But let us see what has been the bright progress of this enterprising firm. Conceding as facts that this company constructed three furnaces at Gartscherrie to a height of 60 ft., or thereabout, being 20 ft. higher than their other adjoining furnaces in blast at this work, and this, too, be it remembered, very many years ago, why, I ask, is it reasonable to suppose that if they obtained advantages by so raising the three furnaces to this height, have they not so raised the others? Or why, granting that they did obtain advantages from this increase of height in the three instances cited, have they not carried the increased height, so much spoken of, to a still greater height to obtain still greater advantages? This is surely not what we might have anticipated were the obtained advantages anything worth speaking of. Would this eminent iron-making firm, "reputed as not being likely to carry on their operations to a disadvantage," have recently erected furnaces of less than 60 ft. in height had this disadvantage not been felt, or at least a nearly total absence of any advantage being found to result therefrom? I do not suppose they would, and, indeed, they would belie the testimony, and upset the argument of "Smelter," were they to do so, for he takes care to tell us that they are "not reputed as being likely to carry on their operations to a disadvantage." I am firmly convinced mere height will never yield any great advantages when raw coal is the fuel used. It is not to be expected that I can quote statistics on this point, adduced from the produce-book at Gartscherrie, in confirmation of what I have advanced as the probable facts; but I believe this company to be a firm who look to business with as astute an eye as any in the trade, and I shall be greatly deceived in my convictions should I find any facts tending to the contrary of what I have stated.

Reviewing such obvious inconsistencies as I have endeavoured to do, I do not wonder, as I proceed with "Smelter's" letter, that my former letter may appear to him a little astounding, but being desirous to speak as plainly as I do honestly, I shall try and clear away the "dim recollections" which evidently envelope him. One of my astounding remarks appears to be that the four columns of the Ferrie furnace give less pressure than one column of the same area, and he scouts the idea of such a thing. Whether his supposed better knowledge on this subject may be the result of his "mechanical reading" I do not know, but I feel sure the merest novice in mechanical philosophy would have offered an explanation showing more "reading," if not of a "mechanical" at least of an intellectual nature, than all the knowledge which "Smelter" seems to have mechanically stored away, and is now its admired possessor. Were "Smelter" to examine the Ferrie furnace, especially the upper portion of it, with a minimum amount of ordinary intelligence, he will find the construction of it in this part lessened in capacity by the interior walls. He will find, further, that by these walls double the amount of position is obtained in the four descending columns, and he will also find, I think, that by the more regular arrangement of the sinking materials it permits the blast passing upwards to permeate more easily through the mass than if it were in a large single chamber.

Without either taking the Glasgow ironmaster "under my wing," or taking wing myself on the question of "how much coal or coke is required per ton of iron," and atoning for the "woeful amount of ignorance" which "Smelter" states I evince, when endorsing the statement "to the effect that 22½ cwt. of coke" is the quantity of smelting fuel English makers have found it possible to use per ton of iron, I offer, in extenuation of this "woeful ignorance," the opinion of, perhaps, the greatest living authority on blast-furnaces. Mr. I. Lowthian Bell, at the meeting of the Iron and Steel Institute, in the discussion which followed the reading of Mr. Ferrie's paper at that meeting, stated, and I repeat his words as reported in the Transactions of the Institute, now before me, that "at Monkland Mr. Ferrie had reduced the consumption of his coal to 35 cwt. Now, at 65 per cent, the equivalent of that in coke is 22, or 22 cwt. to the ton of pig-iron, which, in point of fact, is precisely that which is now being used in the Cleveland district." This, be it observed, is estimating Scotch coal to yield 65 per cent. of coke, a result it cannot give. If we look into Mr. Bell's able and exhaustive paper on the "Manufacture of Iron," which he read to the meeting of the members of the British Association at Newcastle, in the year 1863, we find him stating on the authority of Dr. Richardson, in which he concurred, that while Newcastle district coal gave 60·67; those of Wales, 72·62; those of Derbyshire, 59·32 per cent. of coke; the Scotch coal only gave 54·22 per cent. And if we take the 35 cwt. of coal per ton of No. 1 iron at Monkland as giving only 54·22 per cent. of coke instead of 65 per cent., which is the true state of matters, we get only about 18 cwt. of coke per ton of iron—a result I make bold to say has never yet been attained by either the English or Welsh furnaces. Comparing the furnace also with an ordinary open top Scotch furnace, which was placed against it by the Coltness Iron Company, Mr. Hunter writes—

"Now that we have got the trials in our respective blast-furnaces completed, I think it only due to you [writing to Mr. Ferrie, and which I quote from the Transactions of the Iron and Steel Institute for May last] to write you, expressing how highly I appreciate the cordial way in which you allowed the experiments in your patent furnace with the same material as I use at Coltness for a period of 34 shifts, wrought under the supervision of my own men. I have also to add my high opinion of the value of your patent furnace, as exhibited by the fact of having effected a saving of 35·76 per cent. of coal, 5·80 per cent. of ironstone, and 2·80 per cent. of limestone, against one of the Coltness furnaces, which was treated in exactly the same manner, and whose charges were weighed most carefully, under the inspection of your own men, before being put into the furnace."

It is incorrect of "Smelter" to say that at Ferryhill "less than 20 cwt. of coke per ton of iron is enough in the higher furnaces, for we have both Mr. Bell and Mr. Williams assuring us (Iron and Steel Transactions for May last, pages 336 and 352) that in the Ferryhill furnace, 103½ ft.; Easton, 95 ft.; and in Clarence, 80 ft.;" that the result of their experience was that with all conditions equal there is no perceptible difference to be detected. "Were I to choose," says Mr. Bell, "perhaps, as a mere matter of regularity in working, I, probably, would give the preference to a furnace having a capacity of 15,000 to 16,000 cubic feet, but beyond these dimensions I maintain that nothing has come under my notice to induce me to hope for any advantage, so far as fuel is concerned, by any further addition to height or size." And it "is quite certain," says Mr. Williams, "that in any case beyond 11,000 or 12,000 ft. capacity there is no saving of coke per ton of iron made."

The closing paragraph of "Smelter's" is so thoroughly absurd that I cannot really stop to answer it; it would be "mechanical" madness to do so. "Claiming, as he does," says "Smelter," speaking of my former letter to you, "to take practical views, it is strange to find him indulging in such a description, which is certainly neither practical nor theoretical, and on either basis he will find it difficult to prove that gases would not be fit for combustion." &c. What does he mean? My description of what I considered the probable *modus operandi* is "neither practical nor theoretical." What can it be? And yet he admits they have both a "basis," whatever their superstructure may be. I must ask him to have a look into Whately before again attempting to define a proposition. As for putting his views of the matter to a practical test, I beg that he might prevail upon some of his friends who have "amassed colossal fortunes" to undertake the interesting and important step.

My opinion of the Ferrie furnace is—and it is the very pith of the tree, leaving sapling twigs and tossing leaves aside—that the process of iron smelting has in time past been uniform in practice, inasmuch as coke, either produced separately from the furnace or by means of the flame in it, has been the fuel used. In England coke is made only in ovens for smelting purposes, and from the highly bituminous character of the coal it is the most economical mode of manufacture. In Scotland coke of good quality cannot be made in ovens to advantage, except, as I have said, from a few special thin seams, and since the introduction of the hot-blast the *modus operandi* has been in the furnace, from the action of the flame. By either method, but more particularly by the latter, considerable loss is sustained in carbon and highly useful combustible gases.

In open-topped furnaces using raw coal, the action of the flame

has a very deteriorating effect on the fuel in breaking it up into small pieces, thereby choking the furnace and limiting the production. The choking effect is a most serious drawback to the open-topped mode of coking coal in the present construction of blast-furnaces, for any effort yet made to increase the height above 50 feet, and thereby save coke to the extent of 10 cwt. per ton of iron, as has been done in the Middlesbrough furnaces, has failed. Many, doubtless, may say the open-topped system might be improved, by covering the furnace in the usual way; but any attempt hitherto made in this direction has not been found advantageous.

The cause of the want of success in using raw coal in covered furnaces seems to arise from the absorption of the heat required in the conversion of coal into coke. The heat in a coke oven produced from combustion of gases liberated from the coal does not exist in a covered furnace using raw coal, there being no combustion of gases other than those operated on by the blast, the effects of which diminish in a ratio according to the height of the furnace. In a covered furnace using coke as fuel the source of heat is the same, which will also diminish in a ratio according to height; but the heat so ascending is absorbed and retained by the coke to a greater extent than when raw coal is used by the amount of heat necessary to convert coal into coke, and, therefore, a close-mouthed furnace using raw coal must necessarily use more fuel per ton of iron than a similar furnace using coke. Whether this view of it be either "practical or theoretical," or both, I shall leave with your readers to decide.

A No. 1 IRONMASTER.

#### THE INDUSTRIAL TONTINE SYSTEM.

SIR,—Although well understanding the tontine system, described by your correspondent "Nemo," and acknowledging that in some cases the survivors derive great profit through obtaining a larger proportion of the property than they would otherwise be entitled to; but against this there is the risk inseparably attached to any game of chance, so that it is much like playing with dice, and making each fall of the dice determine the gain or loss of 100%. This is too large a stake for capitalists to play for, who are supposed to exercise some judgment in investing in industrial undertakings.

The combination of the tontine with the life assurance system would make matters worse, because if the tontine die before the close of the tontine his representatives lose the interest on the money invested, and if the tontine live the amount paid for assurance premium must be added to the price paid for the certificate, and thus the alleged advantage of purchasing at the discount would be lost, and in the end he would really obtain a lower rate of interest than if he made the investment in the ordinary way, and without incurring the tontine risk.

R. A.

#### THE PATENT LAWS, AND THE WORKING CLASSES.

SIR,—The appointment of a Select Committee of the House of Commons to "enquire into the law and practice and the effects of grants of letters patents for inventions" will naturally lead to more discussion of that already well-worn subject. This is by no means the first enquiry of the sort. The House of Lords, the House of Commons, the Social Science Association, the British Association, have all dealt with it by committees and commissions. Unfortunately, none of these bodies appear to have sufficiently considered one most important part of the question, and that is the influence of the present patent laws in discouraging the working classes from becoming inventors and patentees. As the question is one of vital national importance, I propose to lay before your readers some considerations on this point, in the hope that it may excite the attention of working men to the possibility of obtaining such changes of the present law as will enable the man of ideas to reap the benefit of those rare possessions, whether he be rich or poor. But if I appeal chiefly to the working class, it is with no wish to serve any selfish class interest. We are more heavily taxed than any nation under the sun. Our voluntary taxation for inebriants is draining us at the rate of 112,000,000. a year. There are nations which have been less successful than ourselves in solving the education question. We have now many formidable industrial rivals where formerly we had none. It is time that we should set our house in order, and do all that is possible to stimulate the inventive genius of our countrymen. Every hand in every workshop in the kingdom should be encouraged to recollect that he has also a head, and that the joint action of these two instruments of labour may with our increased knowledge lead us to still greater inventions in the future than in the past.

No people ever owed so much to invention as the British nation. Inventors have built up these arts and manufactures for which she has long been famous. They have increased her wealth a hundredfold.\* Justice and gratitude (that "lively sense of favours yet to come") alike counsel us to reverse our policy of taxing a man for the possession of brains. It is, therefore, in the interest of no class but for that of the nation at large, that I venture to advocate the reduction of the present enormous fees for patents to a figure that will make it possible for working men to become patentees. The cotton trade, which has added so greatly to the wealth and progress of the nation, owes its wonderful extension, almost its existence, to the inventions of Arkwright, a barber, and of Kay, Hargreaves, and Crompton, all three weavers. The most important of the changes in this manufacture were wrought by working men; it is not until we come to Dr. Cartwright's invention of the power loom that the poor man's monopoly of genius ceases. Crompton's sad history is well known. How nobly Britain rewards her humbler sons, with what munificence she pays them for the toils and struggles they endure for her benefit, may well be seen in his pathetic life-history. After years of continued application he succeeded in inventing that famous machine destined to bring such wealth to Britain. He had spent all his savings in its completion, and was unable to pay the fees necessary to obtain a patent. Then came a wily capitalist, and induced him to reveal his secret under a promise of a liberal subscription from the manufacturers who were to benefit by it. From these liberal-minded individuals, with much difficulty, he obtained 60l. From a grateful nation, after years of importunity at official doors, he received 5000l. There is one law for rich and poor, we are told, in England, but law turns ever a frowning face on poverty. Had Crompton been rich enough to patent his invention, the fruit of his own mind, the outcome of years of toil—had he been able to secure possession of that which was surely more his own than any other possible kind of property—he might have died a millionaire, instead of sinking into the grave crushed by difficulties and misfortune. Such is the history of a working-man inventor who died no longer ago than 1827. The Government charges for a patent have been reduced since that date, but they are still high enough to act as a prohibitory tariff for the man of small means. He is deterred from exercising his inventive abilities, for he cannot reckon upon the fair reward of his talents. He finds it better for his individual interest to keep close to the beaten track, and shun the fields of originality, however fair they may be to his sight.

Surely it is an evil that men should feel discouraged from following up ideas which might lead to great national results. A striking instance of the manner in which the patent laws discourage invention is shown in the evidence of Mr. Richard Roberts, the well-known Manchester engineer, who, at his examination before the Royal Commission of 1864, said:—"With reference to the cost of keeping back patents, I would say that I have a list of something like 100 inventions that I should have patented 30 or 40 years ago but for the cost." Lord Overstone here asked:—"Do you think the public have suffered an injury in consequence of those inventions not having been patented?" Mr. Roberts replied:—"I think so. I think I could mention one by which many lives would have been saved if I had had a patent for it."

\* At the same time it would be well for working men and all of us to pause and consider whether we are not as a nation fast closing our eyes to the truth that the greater the increase in wealth and material resources of a people sinking into luxury and sensual indulgence, only so much the surer and swifter will be its downfall and final dissolution as a nation. Assuredly no British workman who does his own thinking can witness without alarm the enormous increase in the consumption of pauper-making liquors and tobacco which has accompanied the general rise in wages during the present generation. When insurance statistics demonstrate the inferior value of even "moderate drinking lives," and the highest medical authorities pronounce tobacco to be a narcotic poison, let none of us imagine that invention alone can uphold the standard of a nation which, with a pauper roll of 11,761,631, continues to spend annually 112,000,000, on "drink," and an amount upon tobacco equalling its entire expenditure for bread.

But if, notwithstanding these discouragements, the struggling inventor has a heart of hope, and elaborates some crude idea into a successful process, he must either try to work it secretly or secure the assistance of a capitalist. The first plan may be successful in small operations, which can be carried on single-handed, but is clearly impossible in the majority of cases. Where it is possible the secret is confined to one family, and constitutes not a monopoly of 14 years, but a perpetual one. In this case the law with even-handed injustice injures alike the inventor and the public. The difficulties in the way of the second course are almost as great, for except the invention be of almost self-evident utility, or capable of easy demonstration, the capitalist will look very shyly on the poor inventor, whom he will probably regard simply as a dreamer of dreams. Moreover, at present the inventor must divulge his secret, confiding in the honour of the moneyed man. As soon as this is done the weak is in the power of the strong, and how the strong have on some occasions used their power is shown in the case of Crompton.

That the present scale of Government fees in Great Britain is so extravagantly high as to be a prohibitory tax on all but well-to-do inventors will, I think, be admitted by everyone who glances at the following facts:—

Character of patent.	Duration.	Fees.
United States .....	Technically examined .....	17 years ... £ 7 4 0
Great Britain .....	Unexamined .....	14 years ... 175 0 0

In other words, the British patent costs as much as twenty-four American patents! And yet the American patent lasts three years longer, and is much less likely to be upset in case of litigation, for every American patent has undergone a stringent examination as to its originality.

Let us now compare the increase of American patents under this cheap tariff—which enables anyone who has an idea in his head to secure for himself the natural fruit of the phenomenon—with the progress of English inventions under the deadening influence of fees which place the man of brains completely at the mercy of the man of money:—

GREAT BRITAIN.			UNITED STATES.		
Year.	Patents applied for.	Patents completed.	Year.	Patents applied for.	Patents completed.
1854 .....	2764 .....	1876 .....	1854 .....	3,324 .....	1,902 .....
1855 .....	2958 .....	2044 .....	1855 .....	4,435 .....	2,224 .....
1856 .....	3106 .....	2094 .....	1856 .....	4,969 .....	2,502 .....
1857 .....	3200 .....	2028 .....	1857 .....	4,771 .....	2,910 .....
1858 .....	3007 .....	1954 .....	1858 .....	5,364 .....	3,710 .....
1859 .....	3000 .....	1976 .....	1859 .....	6,225 .....	4,538 .....
1860 .....	3196 .....	2061 .....	1860 .....	7,653 .....	4,819 .....
1861 .....	3276 .....	2047 .....	1861 .....	6,643 .....	3,840 .....
1862 .....	3490 .....	2191 .....	1862 .....	6,038 .....	3,521 .....
1863 .....	3409 .....	2094 .....	1863 .....	6,014 .....	4,170 .....
1864 .....	3260 .....	2024 .....	1864 .....	6,932 .....	5,020 .....
1865 .....	3386 .....	2186 .....	1865 .....	10,664 .....	6,616 .....
1866 .....	3453 .....	2124 .....	1866 .....	15,269 .....	9,450 .....
1867 .....	3723 .....	2284 .....	1867 .....	21,276 .....	13,016 .....
1868 .....	3991 .....	2490 .....	1868 .....	24,420 .....	13,378 .....
1869 .....	3786 .....	2408 .....	1869 .....	19,271 .....	13,996 .....

This table is worthy of careful study. The number of applications rejected for want of novelty, &c., in 1869, by the American Patent Office was 5285—above one-third. If we deduct a like proportion from our own unexamined and unweeded applications we shall have less than 3000 valid inventions to compare with the 13,000 issued in the United States. In actual fact, however, only 2408 of this 3000 ever came to maturity. Surely the unvarnished tale which these figures deliver are a sufficient condemnation of the cumbrous and crushing taxation imposed on invention by the English patent law. I commend the figures to the notice of working men, in the hope that they will demand to be heard in the discussion before the select committee, and will cry aloud and spare not until we have fees for patents fixed at a sum that will be within the attainment of the poorest subject of Queen Victoria. I have encroached so far upon your valuable space that I must set aside all detailed enquiry as to the precise changes required. The suggestion of the Manchester Patent Law Reform Association to abolish the system of provisional specifications, and to substitute in its place a system of registration at a trifling cost, giving twelve months' protection, in which the inventor might perfect his plan before taking out letters patent, appears to be the wisest solution of the questions involved.

The essential point is that patents should be cheap. There can be no valid reason why working men should be asked to pay more for the registering, and 12 months' protection of an invention, than the actual cost of making the record. A small annual tax subsequently during the existence of the patent would, with the great increase in the patent roll certain to follow the cheapening of the charges, abundantly suffice to maintain the staff and publication expenses of the Patent Office. By all means let us have a patent law intended to do equal justice to rich and poor, and under its genial encouragement invention will successfully busy itself with every art. With our natural advantages, and the stimulus of such a law, we might hope to see English manufactures improve and progress at a rate that would enable us to leave all our competitors far behind.

#### ONE OF THE WORKING CLASSES.

P.S.—The objections sometimes urged against cheap patents will be considered in a second letter.

#### PRACTICAL MINING—HIGH-FALL STAMPS.

SIR,—As it is, I think, one of your fundamental rules to demand the proper name and address of every correspondent as a condition for publishing his communications, it is scarcely fair that Messrs. Searle and Mufford should be permitted to describe as "an anonymous correspondent" the author of any letter in the *Mining Journal*, merely because he does not think proper to have his name paraded in print. He may have good reason for withholding, or there may be an absence of reason for publishing, his name, and yet he may desire to support truth; for example, he may have no invention to advertise for sale, nor any interest in copying Mr. Mufford so closely as to describe in 1871 as a new invention a design for a machine, which (as Mr. Mufford now asserts) was exhibited at the Cornwall Polytechnic Society at Falmouth in 1861, or just ten years ago. Now, if Mr. Mufford were writing a general political history he would, no doubt, be justified in regarding an event which occurred ten years since as modern, but when it becomes a question of apparatus at present used in mining, an invention ten years old is usually regarded as ancient. Mr. Mufford is quite mistaken in supposing that I desire to deprive his friend of any honour that he may be entitled to; but I do protest against the practice of publishing infernal descriptions of machines with a view to prejudice the adoption of machinery patented and honestly brought forward in the public newspapers. The assertion as to Mr. Searle's letter on March 2 is worthless, since the invention described in the *Journal* of April 22 was patented before March. But this is immaterial, since it is the principle that I am attacking, and not Mr. Searle's plagiarism in particular. I have no pecuniary interest in any inventions whatever further than that arising from the advantage of using them, but if an invention is useful I never object to pay royalty.

In all descriptions of machinery the Cornishmen are far behind the miners of other countries, and but for the German apparatus at present used in Cornwall the county would long since have ceased to be known except in history amongst the mining districts of the world; if it had been possible, therefore, with any degree of truth to have given credit for Mr. Walker's high-fall stamps to Mr. Searle I should willingly have done so, if for no other purpose than to prove that Cornishmen really do sometimes invent a mine machine. As to Mr. Searle's letter, my first reply to it must be that I regret that I should have ruffled his temper, especially when I think of the old story of the ignoramus who used to listen to the disputation of certain Grecian orators, although he did not understand the language, declaring that he enjoyed it, and could always tell which had the worst of the argument, because the loser could never keep his temper. For his information, in a legal sense, that the Patent Law as it at present stands recognises as the first inventor him who first publishes an invention to the world; and I may further tell him that writing to a patent agent, and enquiring the price for securing a patent is not equivalent to obtaining a patent. I should be sorry to be treated with contempt by Mr. Searle, but I must ask him not in future to infer that Mr. Warrington Smyth, as Chief Mineral Inspector for the Crown (though I do not deny his right in his private capacity) can send machinists to Spain, and thus prevent them from attending to their own business, even in so important a matter as patenting an invention. I do not wish to buy an invention, as Mr. Searle suggests,



although were I to buy his at its commercial value it might not (if its use be prohibited by other patents' rights) necessitate a large outlay. I will only repeat my request for mechanical details upon the grounds stated in my former letter. E. O.  
Cross-lane, June 20.

#### AMERICAN MINING SPECULATION.

SIR,—The *Times*' correspondent, "P," writes in the Money Article of that journal, on June 4, making the assertion that the mines that have been bought in London during the past year or two have all been sold—only on the representation of the vendors and agents. You will, I hope, assist me to distinctly deny this gross misstatement, which impugns the conduct of all the agents, directors, stock-brokers, and others now operating in this branch of business.

I defy the said writer to name one mine that has been sold in this market without first having been inspected by an English mining engineer, selected by the purchasers, and sent out from here to verify all statements. The result of the last ten years business in London is about as follows:—Over one million sterling has been invested in developed and dividend-paying American mines (not "wild cats.") The result has been more than satisfactory. Most of the properties pay regular quarterly dividends, and the gross subscribed capital has nearly doubled in value.

Having acted as agent for the sale of several of these properties, I am as anxious as the press can be to stamp out anything that is "Bogus," and endeavour to maintain the high character that American mines now hold on this market. H. H. ROCHE.  
Palmerston-buildings, City, June 21.

#### MINING IN SWEDEN—THE SOLSTAD MINES.

SIR,—I very much regret that some errors should have crept into my communication, under the above heading, which you were kind enough to publish in the Supplement to the Journal of May 6. In the first paragraph it should have read—An interest created by such a cause is one equally valuable, as it is significant of an apprehending faculty that a higher ground is attainable, and may be assumed accordant with recognised fundamental principles as a guide to mining. And again, in the same paragraph—The best prelude to knowledge is a "conviction" of its absolute utility and power, and not a "combination" of its absolute utility and power. In the second paragraph it should have read—The communication under the above heading in the Journal of February 25 points in a direction which, if pursued, leads to and opens up a field of view in physics as instructive and edifying as it is interesting.

In the third paragraph it should have read—It then assumed a course "parallel to it, and not a "converse" parallel to it.

In the eighth paragraph it should have read—By the joint action of the attractive and *affinitive* forces, and not "affirmative" forces, as rendered.

In the twelfth paragraph it should have read—Performs only its natural functions as a solvent in reducing and absorbing, for which it has ample capacity, and conducting, for on it is the impress of "mobility," and not "malleability." And further on, in the same paragraph, it should have read—From the mild, though no less stern, "aspiration" of visionary, instead of "expression" of visionary.

There are a few minor misprints, which I will not trespass further on your valuable space to mention, as I have no doubt I am as much to blame for the whole as anyone; my comparative illegibility of writing naturally conduces to such a result.

I will thank you to allow this correction to appear in your next subsequent issue. ROBERT KNAPP.

Ellsworth, Nye County, Nevada, June 1.

#### SCIENCE AND THE EMPIRIC ART INSEPARABLE IN MINING.

SIR,—I will thank you to afford me space for a few further remarks on the ungenerous, and, I may add, uningenious attack of "Critic" on my letter of Feb. 15, under the above heading. Its repudiation only serves to confirm me in the opinion that next to ill-feeling ignorance could only have dictated such an effusion. The conceit which culminates in pronouncing everything nonsense which it does not understand has itself transcended, if possible, the acme of folly in combining, as it does, impertinence with denser ignorance. Every person of any experience whatever in committing his thoughts to writing knows how painfully prolix it would be both to himself and his readers to make himself understood on a great variety of subjects if denied the use of figurative expressions; he would be reduced to the school-book primer style of language, and his fastidious modesty degenerating into weakness, would be deservedly scouted. I am well aware that, whenever practicable, plain language is far preferable to figurative. At the same time it will not, I think, be denied that the former, like the latter, has its limitations both in writing and in speaking.

Scarcely a day passes but what I see illustrations in practical life of the discordant and inharmonious results of assailing complex truths in natural philosophy with only a partial knowledge, or one-sided view, of their conditions. Who amongst practical—especially mining—men have not witnessed error committed in assailing complex truths with only the knowledge incidental to a partial or limited acquaintance with their character? What is the lesson intended to be conveyed by the maxim "a little knowledge is a dangerous thing" if it does not apply to questions like those under consideration? Are men of one idea, who have no capacity for seeing more than one thing at a time, superior to men of large experience and comprehensive minds? And are the latter to be censured by the former because their natural outlook is so elevated and commanding that they cannot contract their view so as to see only one thing at a time? It may be only proper to remark here, to avoid the imputation of egotism, that myself nor any other individual as such is alluded to in the above paragraph, but a class of individuals in opposition to the following. It is very common for men of one idea to flatter themselves that because they see no other they monopolise all that is. If illustrations were needed of the inconveniences arising from the imperfection of knowledge to which allusion was made in the obnoxious paragraph of my letter, the science of metallurgy would of itself afford abundant evidence, whilst other branches of chemistry—especially in the preparation of explosive compounds—would add additional evidence thereto. Indeed, practical life in its every department affords a thousand and a thousand proofs of man's shortsightedness in presumptuously battling against Nature's laws, in utter ignorance of their existence. He sees a part, but does not see that it exists and acts in unison with other parts, and without which it could not act, and hence his numberless blunderings and their consequent disasters. How often is the want of comprehensiveness charged upon men entrusted with the conduct of complex affairs, and how often have efforts been misdirected by a little light, which proved not only futile, but more disastrous than entire ignorance of the whole thing would have resulted in.

"Critic" is of opinion that the readers of the Journal have a right to ask that the viands set before them in its pages should be congenial to their palates. If such an experiment were possible the Journal would become the greatest literary curiosity in the universe. But all sensible subscribers to the Journal are agreed to accept of what the Editor sets before them, having sufficient confidence in his judgment. Such an assumption as that of "Critic's" could only have culminated in arrogance personified.

I could desire no better subject than "Critic" to illustrate almost every paragraph of my letter to which exception has been taken by him. I stated therein that thousands of valuable facts of experience were never disseminated, but were treasured and finally entombed in the minds that gave them birth; and I have now no hesitation in adding that in numberless instances it has been through the instrumentality of "scare-crows" like "Critic." Who is the arbiter, and where is the standard, in the midst of a condition of things as changing as the face of Nature itself throughout the varied seasons of the year? But before proceeding further allow me to digress a little that I may enjoy the luxury of retaliation by criticising the critique of my censor, and to exhibit the inconsistencies of that performance.

In the first paragraph he speaks of the title of my letter—Science

and the Empiric Art Inseparable in Mining—as a strange title, and then immediately maintains in the same paragraph "the" interdependence of art and science in aiding the progress of civilisation. I had previously said, it may be observed, in the second paragraph of my letter, that the progress of advanced and advancing civilisation was underlain by mining. It is difficult to conceive how one mode of expression can be wrong if the other is right. Perhaps "Critic" may condescendingly point out the difference of what I shall have the temerity to call, meanwhile, the same thing. In the next paragraph, after expressing his regret that persons having anything of value to communicate should adopt any other than a simple, clear, and unpretending style, of which my whole letter, he affirms, is an example to the contrary, he immediately adds—how simple and intelligible is "this" passage, and then proceeds to quote accordingly. "An error to which mankind is very liable," &c., followed by an exclamation of unmitigated severity—there may be a clear and intelligent idea beneath this mass of words, &c. I take the liberty here of saying that such a form of expression, "intelligent idea," may be good English, and very properly expressed, but my fastidiousness always leads me to avoid clothing such an abstract thing as an idea with the attributes or qualities of a living agent.

"Critic" assumes to appreciate an unpretending style of writing; perhaps he will be good enough to point out the difference between pretence and affectation—as to their value I mean, not their conventional difference, for I am well aware that in this respect they tend to two extremes, of which "Critic" and myself may be sufficiently good illustrations. If "Critic's" style of writing were to be adopted as the popular style, it is quite clear that the greater and more numerous the inconsistencies and contradictions the more perfect would be the similitude. It is clearly equally characterised by inconsistencies, contradictions, and affectation. As an example of the latter, I need only notice the following as a specimen of affected power, tempered by equally affected clemency:—"I have endeavoured to avoid being too severe upon Mr. Robert Knapp," &c. I think it is quite within the limits of possibility that he may eventually discover how supremely indifferent I am to any castigation he may suppose himself qualified to administer, especially if his recent effort may be regarded as a criterion of his qualifications for such an undertaking.

It seems never to have occurred to "Critic" that the obscurity of an article at the time of his perusing it may be nothing more than the reflex of his own confused ideas. It is almost incredible that anyone in a less degree of obliviousness than somnambulism could possibly infer from my letter that I either opposed book learning or experience. How would it be possible for anyone to acquire even a limited knowledge of so many branches of science as pertains to mining, some of which I enumerated, with any degree of accuracy, without having recourse to books, and to many of them? Another inference of "Critic's," deduced from the foregoing, is no less absurd—that none but a genius could ever become an accomplished miner. Just the reverse is what reason would have determined from the whole or any portion of my letter. The comprehensive and adaptive qualities of mind by which a good mining engineer is distinguished are just what a genius in ninety-nine cases out of every hundred does not possess. His qualities are of a different kind, converging to a focus, concentrating on an object, one at a time, whether complex or simple, as a general rule. But these things only afford additional illustrations of the difference of ideas between "Critic" and myself respecting the import of language.

But to return; the theme upon which I dilated was practical mining, and I flatter myself I am somewhat at home in that field, having now been upwards of 40 years identified with its pursuits and most arduous duties, of which it is to be presumed that "Critic" knows nothing, and little, if anything, of its theory.

I wrote you briefly and hastily immediately on receipt of the Journal bearing "Critic's" strictures on my communication, but did not enter into the matter as fully as I should have done had more time been available. I hope the publication of this second paper will not be too great a trespass on your generosity and space.

The subject of my letter, to which this refers, whether properly discussed therein or not, is one of great importance, affecting one of the greatest industries of this and all coming times.

Ellsworth, Nye County, Nevada, June 1.

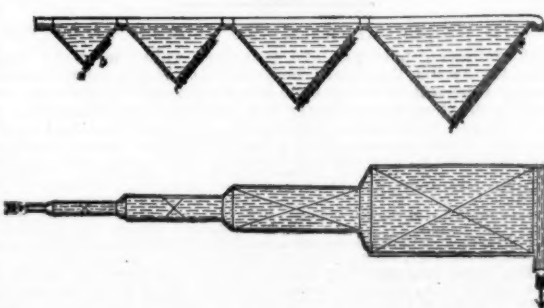
ROBERT KNAPP.

#### ON THE DRESSING OF ORES—No. IX.

**PYRAMIDAL TROUGHS.**—The employment of pyramidal troughs has modified and improved the classifying of fine materials; for when the stuff passes into the successive troughs or divisions which constitute the apparatus there is produced, at its immediate entrance, an advantageous spreading of the matter, which isolates the constituent grains; and as the section of the trough through which the current passes is never obstructed by deposits, and remains invariable, it follows that the running water maintains an equality of movement throughout its course. Thus, the grains perform their descent under unvarying conditions, and reach the bottom without perturbation.

Moreover, as the bottom of the trough is pierced with a small hole, facility is afforded to the sand to pass off immediately it reaches the bottom, and thus, without labour, it may be directly conveyed to the enriching machines. A set of boxes is shown in Fig. 1, and the sides are set at an angle of not less than 50°. Sand and water are introduced at the narrow end, and immediately the coarsest and the heaviest particles—by reason of the diminishing velocity of the current—begin to drop to the outlet-hole, and the poorer and lighter stuff passes off at the top. If a second larger trough be connected with the first, a third of still greater dimensions to the second, and any additional number under the same increasing ratio as to size, it follows that the same process of settling and escaping of the grains will take place, and that their size will be decreased nearly in inverse proportion as the surface of a succeeding trough is greater than that of the trough which preceded it, or directly as the velocity of the water is diminished in it. The size of different troughs to ensure a good classification will depend on the amount of material to pass through them per second, and the size and character of the grains. Practically, it has been determined that for every cubic foot of material the width of the first or smallest trough must be 1½ in., or (say) 24 in. wide for 20 cubic feet. For every succeeding trough it ought to be double that of the preceding one, or, in other words, the width of the troughs should increase nearly in geometrical progression, 2, 4, 8, &c., and their lengths in an arithmetical one, 3, 6, 9, &c. The way in which the outlet-holes are managed to obviate the effect of hydrostatic pressure, and to prevent chokage, is important. In the first place, the holes are made sufficiently large to pass the coarsest sand, and in the second, they are connected with a pipe, ½ in. in diameter, which runs up the side of the trough, and is furnished with small mouth-piece and regulating-tap. In order to ensure a satisfactory result, the sand and water must be fed uniformly to the troughs without eddy or admissions of extraneous substances.

Fig. 1.

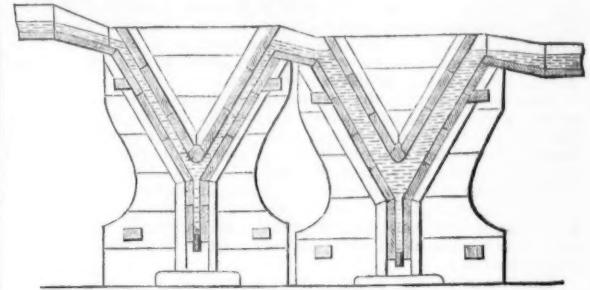


Plan.

**TRIANGULAR DOUBLE TROUGHS.**—This invention, by Rittinger, is based upon the principle that if sand, composed of particles different in size and density, be exposed to an ascending current of water, the velocity of such current can be so regulated as to permit the large particles to sink, and the small ones to go off with the surface stream.

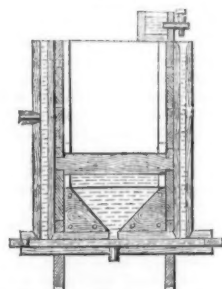
By repeating such an operation two or three times, the sand can be separated into as many different classes, and rendered suitable for a similar number of concentrating machines. A set of triangular troughs is shown in Fig. 2, Fig. 3 being a cross-section of one of the troughs. Each trough is made of a definite length and width, two sides being vertical, and two inclined at an angle of 60°; at a small distance from the bottom inclined sides, parallel boards are fixed, and constitute, as it were, a gullet or passage-way. Through the gullet the sand will both fall and rise, and as the velocity of the stream will depend on the width of the opening, so also in turn will depend the size of the grains carried to the top, and discharged at the bottom. The cross-section and respective velocity stand in inverse relation to each other, and their determination for each double trough of a classifying apparatus is a matter of calculation, in which the size of the largest particles and the specific weight of stuff to be separated form the main figures. For galena, in which the largest grains do not exceed 6-10 millimetre in diameter, the most satisfactory results seem to be obtained by a series of four double troughs, with the velocity of the stream decreasing from the first to the three succeeding troughs in the progression of 2.3, 0.94, 0.37, 0.15 in. per second. If, therefore, the width of the channel for the first trough is 1.1, and its length 2 ft., then the width of the channel in the next trough is 2.75 in., the length being 2 feet. As, however, it is not advisable to increase the width of the channel beyond 3 in. wide, the passages in the third and fourth troughs, 3 in. wide, are respectively 5½ in. and 13½ in. long. The mean depth of the channels, measured from the influx line of the sand to the lowest part of the inside trough, is, for the two smaller ones, about 36 in., and for the two larger ones, 4 to 6 ft. In order to carry off the coarse particles that sink in the channels, the inclined sides of the troughs do not meet below, but are continued downward, forming a long-pointed opening about 1½ in. wide. The short side at bottom slopes inwards, at an angle of not less than 50°, contracting the opening to a small hole, about 1 in. square at bottom, through which the sand is discharged into a horizontal pipe. The outlet is carried up to within 20 to 35 in. of the water-line, according to the degree of fineness of the grains that have to pass through it. A tap in small launder serves to regulate the outflow. A pipe conveys clear water from the launder, and as the water in the pipe stands 6 to 8 inches above the water level in the troughs, a steady pressure is produced at the opening at the bottom, which is essential for good classification. The double troughs are fixed exactly level, and sufficiently below each other to prevent any settlement of material in the communication launder. A series of four double troughs will classify the coarser kind of grains better and clearer than a similar number of pyramidal troughs, but for fine slimes below ½ millimetre size the latter are, perhaps, preferable.

Fig. 2.



Plan.

Fig. 3.



Cross Section.

**CLASSIFYING LAUNDER.**—In some of the German dressing-works fine sand from the top of slime peters, and from fine-grain sizing trommels, flow into an expanding launder, in which the particles are classified and collected, according to their equivalents. The total length of one of these classifying launders is 28 ft. 4 in. The trough, including the first four divisions, 10, 13, 17, and 22 in. wide respectively, is 3 ft. deep and 6 ft. 8 in. broad at the top, with one side set at an angle of 45°, the other at 60°. The second, connected with the first trough, contains five divisions, each 29, 39, 52, 67, and 88½ in. wide, 7 ft. 7 in. broad, and 4 ft. deep. The stream-launder at the entrance of the slime water is 10 in. wide and 4 in. deep. From this point to the further or effluent end, the width is gradually increased to 36 in., and the depth to 18 in. Along the bottom is a continuous opening ¼ in. wide. The water-launder, which carries the stream-launder, is 40 in. wide and 6 in. deep, and is pierced with plug-holes 1 inch in diameter.

The gradual widening of this launder occasions a corresponding decrease in the velocity of the stream, and a deposition of the grains in the several hutches, according to their respective equivalents. This necessary result is assisted, and subject to modification, by allowing more or less clear water to pass through the plug-holes. The distance between each plug-hole in the water launder is progressively greater as the stream launder widens. This feature is one of some moment, inasmuch as the volume of water is thereby lessened with the decrease that occurs in the equivalent value of the grains. The water launder delivers to the apparatus from 150 to 200 gallons per minute. At Altglück, the troughs and launders are made of beech plank 2 in. thick. The first four sand hutches are emptied once a day, the remaining five once a fortnight. Each of the nine sorts of stuff is kept, and treated separately on suitable dressing machines.

2, Coleman-street-buildings, London.

JOHN DARLINGTON.

#### MINING IN CARDIGANSHIRE.

SIR,—The next mine to speak of will be the CEFN CWM BRWYNO, situate about half-a-mile to the north of Bwadrain Mine, and about a mile west of Powell United, and its rich workings for the past years are now perfectly put in the shade according to the present appearance of the bottom of the mine, which is the 92 ft. level. The shaft is again being sunk down another 10 or 12 ft.; the lode in the present bottom looks more encouraging and promising than it has for the last three or four levels; also the lode in the east and west in the 80 and 90 ft. levels is looking remarkably well. The mine at this day looks better than it has for the last ten or twelve years. So much, then, for perseverance on the part of our Cardiganshire agents. This is the Powell United lode. On surface I find they are about



erecting a new water-wheel, of beautiful castings: I think it is about 38 ft. by 24 ft. breast. This wheel will be the engine-wheel, pumping the underground water alone—so that the wheel which has been doing this work, and driving a crusher as well, will have henceforth nothing but the crusher to keep going, and we may naturally look out for an increase in the sale of mineral, which is and has been about 30 tons monthly. The water in this mine throughout has been well supplied from the mountain lakes, the property of the Goginan Mine, which mine is on the western course to town, and upon which I would speak but little, as it is, and has been for the last thirty odd years, so well known to every mining man who has had the pleasure of visiting Cardiganshire, yet I would here mention, although at one time almost abandoned, another tug at the tackle has brought it to life, and as we well know that by perseverance and a little patience it may rise as high, if not higher, than it did thirty years ago. There is scarcely a mine in this country that is worth anything but what at one time was abandoned through poverty. There are other mines in the neighbourhood which I intend making mention of in my next week's report: some have been worked, abandoned, and again put on, and at this moment are progressing to the top of the list of Cardiganshire mines, so it is not known when we may meet with a Goginan of thirty years ago, a second Bronfloyd, or a sister East Darren—the Old Cwmsymlog, which helped to water the City of London with its New River.

The advice of some agent well known to and by the country should be taken by those intending to invest, for there are at this present moment virgin settlements as good, doubtless, as any that have ever been worked, and may prosper as well. Penllwyn, Aberystwyth, June 20. SAMPOSS TREYETHAN, M.C.E.

#### THE DEVON GREAT CONSOLS.

SIR.—Mr. Gill, of Tavistock, evidently labouring under extreme uneasiness, arising from the observations addressed to him by the Chairman at the late annual meeting of these mines, and feeling that his efforts for years past to shake the reputation of the directory and management have utterly failed, has within the past few days issued a "paper" in justification of the course of procedure he has deemed it his duty as a shareholder, and his position as a gentleman, to adopt; and as he has honoured me with one of these "papers," and as it is not by any means probable that the directors will condescend to reply to this tissue of trivial, unreasonable, and unjust statements, I wish, with your permission, through the medium of the Journal, to make a few general remarks thereon.

At the outset I would observe that a somewhat similar document was written some years since; and as that document emanated from one of intellectual capacity, and of some acquaintance with practical mining, the statements he published, unfounded as they were, created a panic, which had the effect of lowering the marketable value of the property to the extent of 100,000L. That panic, however, proved of very short duration, and the mines continued in their usual course of prosperity. The present movement, for obvious reasons, has caused no panic whatever.

It would, however, seem clear, from the present proceedings on the part of the author of this pamphlet, that he deems himself competent to undertake the direction of the affairs of the Devon Great Consols, and is anxious to displace the present directory; it may, therefore, perhaps, be but fair and reasonable under the circumstances to enquire how it happens that a gentleman capable of displaying such ability in the management of the affairs of others has proved so in differently successful in affairs of his own?

How, for instance, is the fact accounted for that the business of a company which enjoyed a leading position in one of the most flourishing towns in the West of England has become totally extinct? And how, moreover, has the same company, with unlimited capital, and a most extensive connection, allowed one of the best quays on one of the finest navigable rivers in the kingdom, and the canal in connection therewith, to lie dormant, and the inhabitants of the village adjoining to want employment, whilst their intelligent and obliging neighbours, without the same advantages, command the trade of the whole district?

This line of enquiry might be continued still further, with regard to other branches with which the author is identified, but the instances adduced will probably suffice.

Before removing the directory and management of these mines from the hands of those who have so honourably and efficiently conducted the affairs of the company for the past quarter of a century, the shareholders will, the author may be assured, require some higher guarantee than has yet been exhibited of his ability to conduct the affairs of this great and still prosperous enterprise.

June 21.

ONE INTERESTED.

#### BRITISH MINING, ANCIENT AND MODERN.

SIR.—Although mining is much more respected now than it was some years ago, there are many persons who affect to hold our mining industry in contempt, and to disparage investment in that department of work. I maintain that it has been and is the most profitable of all British or foreign adventures, and that the history of this industry is more replete with interest to Englishmen than that of any other. Long before our textile manufactures had an existence, although now thought so much of, mines occupied the people, and were even identified with the earliest civilisation of the country.

There was no form of remunerative labour with which the Romans were engaged in England and the Principality of which we have such clear accounts and such well-defined traces as of this. But long before the Romans came the Britons mined, and their interest in metals connects itself with the most ancient chapters of the history of the country.

The way in which the ancient history of the country has been written accounts in a great measure for the want of general interest, and even for the want of curiosity, on the part of the educated classes concerning the metalliferous districts, just as the "bulling" and "bearing" in mining shares on the Stock Exchange and elsewhere has given a fictitious character to mining investment, under which its true nature, value, and reality remained a long time buried. It is astonishing that a writer of such reputation as Hume should introduce his History of England by saying—"Neglecting, therefore, all traditions, or rather tales, concerning the more early history of Britain, we shall only consider the state of the inhabitants as it appeared to the Romans on their invasion." Now, the Romans were a long time in England before they were qualified to give an account of it, and their relations were tinged with prejudice and national contempt. It is true that intelligent and indomitable people made themselves acquainted with the remotest districts of the country, and searched for its mineral treasures, but chiefly in the spots where the ancient inhabitants had worked before them.

That Cornwall is the chief district for ancient and modern mining worked productively, as it now is, has been asserted, and I think proved in some of my former letters, in my work called "The Mines of Cornwall and Devon," and in my work entitled "The Mining Atlas." Hume, the historian, however, would at the very outset of his history bring a doubt upon such an opinion. He depreciates the study of ancient Britain as that of an utterly barbarous country, observing—"The convulsions of a civilised state usually compose the most instructive and most interesting portions of its history; but the sudden, violent, and unprepared revolutions incident to barbarians are so much guided by caprice and terminate so often in cruelty that they disgust us by the uniformity of their appearance." Now, Europe, especially France—but, in fact, every portion of Europe—reveals the fact that during what Mr. Hume would recognise as the historic or civilised period convulsions have been as fitful and as sanguinary as ever they were in times or nations called by him barbarous. The historian quoted agreed with many other annalists who preceded him that the Britons were a tribe of the Gauls, but inferior to them in civilisation, from the contiguity of France to enlightened and civilised Italy; but that contiguity was not facile of communication, nor were the Italian borders characterised by the high civilisation of Rome and Southern Italy. So far from the Gauls being in a superior condition to the ancient Britons, we have many proofs to the contrary. The fabrication of ornaments, arms, chariots, and implements of social and industrial life were superior, on the whole, to what Gaul at an equally early period exhibited. It is authenticated, too, by antiquarian research that the ancient Britons of the south-west used wheel cars or carts drawn by horses for carriage and transport in their traffic, while Gaul was traversed for like purposes only by pack-horses. It was in this way the tin was borne hundreds of miles through Gaul to the shores of the Mediterranean.

The Britons were in consequence of their tin treasures a commercial people. Hume says that the Greek and Roman navigators brought home shocking accounts of the ferocity of these people, and he assures us that there were scarcely any other travellers in those ages. But the Phœnicians were before the Greeks in commercial

and maritime enterprise, as well as in literature, and that people, long before the Greeks discovered the source of their supply knew the "Tin Isles," and trafficked with them. Jews also came over in Syrian and Sidonian ships, and established themselves as tin merchants in Cornwall, just as effectively and commercially as the Dutch at this day do in the Great Eastern Archipelago. Indeed, the Jews gave name to a place near St. Michael's Mount, in one of the great ancient mining districts of Cornwall, which continues to this day—Marazion, the Market of Zion, or Jew's Market. There are Hebrew and Celtic words engrafted upon the old dialects of these islands, in the result of this intercourse, which remain to this day. It is probable that the tin of Cornwall contributed to the decorations of Solomon's temple, bought in that district by Jews and Phœnicians, then allied, and borne by the ships of Tyre and Sidon to the Syrian coast.

Ancient Britain was not, then, the barbarous country some historians have maintained, and her ancient civilisation was promoted by mining. We will admit that the mode of working was simple in those days, manual labour doing everything; but even to-day the science and mechanical power are not brought to bear upon metalliferous mines that should be and will be. If such skill and adequate machinery be applied, Cornwall and its confines, as well as South Wales and some other portions of the British Isles, will prove a splendid field of adventure, and recompense the care and science of the engineer and the enterprise and capital of the investor. Already the improvement in the metal trade has caused numerous mines to be opened in Cornwall especially, and re-opened, where copper was formerly mined, and tin is now more richly produced—the cuperiferous treasures giving place to the latter.

Perhaps there was never a time when mining ought to be so much a matter of research as to its history, study as to its phenomena, boldness as to its operations, and enterprise and confidence as to the capital employed in it, as now. At all events, a new era has dawned, and happy will be the investors who engage their money in well-chosen prospective mines.

Gresham House, Old Broad-street, London, June 22.

#### PARYS MOUNTAIN MINE.

SIR.—Whilst, as pointed out in my letter of last week, the old portion of this mine affords every promise of permanent prosperity, and of continually fresh development, it is to Morfa Du that general expectation looks to the possibility—or, from the ascertained facts, it may even be said to the probability—of a repetition of the extraordinarily splendid results achieved by the "open cast" deposit. The conditions warranting the ground of such probability may be briefly stated. In this western (Morfa Du) portion of the property is a prominent white quartz rock, exactly similar to that which old inhabitants of the district declare surmounted the great deposit of the open cast. The rich lodes that constituted the immense quantity of copper ore quarried out would, if continued, almost necessarily pass west into Morfa Du; nor is there any reason to suppose but that they do so. A coasting pit has been sunk a few fathoms, and a lode been intersected containing copper of good quality, galena, and iron pyrites. Owing to the irruption of water, the prosecution of this work had to be discontinued, but an adit is now being driven which will drain off the water several fathoms below the bottom of the shaft, and enable the lode to be further proved. In making this adit a large quantity of bluestone has been met with; and it is remarkable that not only were thousands of tons of this bluestone found in the open cast, but that the association of metals now found in the White Rock shaft was also characteristic of the back of the great accumulation of sulphuretted copper there discovered.

A not unimportant element in the property of the company is the right to search for and work minerals on the Parys Farm. This tract of 250 acres to the west and north-west of Morfa Du is as yet untouched ground, except that the cutting of a small trench has revealed the presence of yellow copper ore. A special feature in the Parys Mine consists of the "precipitate pits." These are reservoirs of some acres in extent, bricked and cemented, and having old iron spread upon the floors. The mineralised water from the levels, and also the rain-water after passing through the immense heaps of debris, is led into these pits, depositing copper upon the iron scrap. The forces of nature are thus utilised, and the waste mounds of refuse workings of half a century since are still doing good service. The annual produce from this source is about 350 tons, of the value of 8L per ton. But there is still virtue in the "strong water." The supernatant liquid is not yet to be allowed to escape freely to commingle with the waves of the Irish sea until further toll has been extracted from it. After most of its cupreous constituents have been arrested by the action of the iron it is drawn off charged with a certain combination of this metal, and forms small lakes of rich blue and purple colour in the vicinity of the mountain. If a glass full of this apparently clear fluid be tested with ammonia the solid matter is immediately thrown down from the solution, but by the more inexpensive, if slower, operation of time the yellow ochre is precipitated for the profit of the Parys Mountain Mine Company (Limited) to the extent of 500 tons per annum. The selling price of this substance varies according to the demand, but may be averaged at 30s. per ton. Another source of revenue that should not be forgotten is native ochre. Quite recently a new cutting from the open cast has led to the discovery of an enormous deposit of this material, and which is now being extensively quarried.

Of halvans there is an almost inexhaustible stock, and it is only a question of how much the machinery, which is extensive and in perfect order, can treat. It might, perhaps, be a not unwise economy, as well as a philanthropic measure, if the company were to provide for the showy and picturesque looking girls who work the jiggers a light zinc or galvanised iron roof over their heads, instead of leaving them, as now exposed to all weathers.

There is a considerable property that the shareholders may calculate upon in the amount of preparatory work already done in the mine—shafts, levels, winzes, and nearly all the communications being in admirable condition, and ready to be taken advantage of when the directors think proper to recommence upon various reserved sections, that have probably been left until an improvement upon the present unprecedentedly low price of copper shall take place. There are many soft cross-courses in the mine, and which are used for cross-cutting, at less than half the cost that would have been entailed by blasting through the hard rock—Lower Silurian and felsephatic trap—of the country. The lodes in this mine run 15° N. of W. and S. of E., and the underlie varies from 2 to 4 feet per fathom. Capt. Mitchell, an old experienced Cornish and Chilean copper miner, has given it as his deliberate opinion that there is no British copper mine that capitalists can more safely invest in for the present, or with better chances for the future, than the Parys Mountain Mine Company, (Limited).

PATENTIA.

[For remainder of Original Correspondence see to-day's Journal.]

#### NORTH WALES ORDNDANCE AND GEOLOGICAL SURVEY.

The following noblemen and gentlemen waited upon the Right Hon. Mr. Ayrton, the Chief Commissioner of Works, on Wednesday last, as a deputation to urge upon him the desirability of at once extending the Government Survey now being made at the Counties of Denbigh and Flint to the other counties of North Wales and Cardiganshire. The deputation consisted of Lord Mostyn, Lord Richard Grosvenor, M.P., Sir Watkin W. Wynne, Bart., M.P., Sir John Hanmer, Bart., M.P., the Hon. W. O. Stanley, M.P., the Hon. Hanbury Tracy, M.P., Mr. Charles W. Wynne, M.P., Mr. Jones-Parry, M.P., Mr. E. M. Richards, M.P., Mr. G. O. Morgan, M.P., Mr. Richard Davies, M.P., Mr. Holland, M.P., Mr. Bulkeley Hughes, M.P., Mr. Watkin Williams, M.P., Mr. Whalley, M.P., Mr. R. Buckley, M.P., Capt. Crewe Read (Llandinam), Mr. Morgan Lloyd, Mr. Edward Breeze. The deputation was introduced by Lord Mostyn and Lord Richard Grosvenor, and the Hon. W. O. Stanley asked Mr. Morgan Lloyd to state the object of the deputation.

Mr. Lloyd said that they had learnt that the survey of Scotland, on a scale of 25 in. to the mile, supplemented by a survey of the mountain districts on a scale of 6 in. to the mile, would be completed this year, and that a portion of the staff employed there would be then free to be employed in some district south of the Tweed. They also understood that the triangulation of Denbighshire and Flintshire would be completed about the same period. They, therefore, considered the present a fitting opportunity to ask the Government that a portion of the staff which would then be at liberty to undertake new surveys should be employed in extending the survey going on in the counties of Denbigh and Flint over the other counties of North Wales and Cardiganshire. He submitted that the counties named were in a geological point of view one of the most important districts in the kingdom. There was there Sir Roderick Murchison had elaborated his great work upon the Silurian System, and the class

fication and nomenclature of the older rocks which were now adopted throughout the world were based upon the study of the rocks prevailing in that district. It was, therefore, of great importance, with a view to the advancement of geological science, that the country should possess a survey on an adequate scale of that part of the kingdom.

North Wales was a rich mineral district, and as such contributed largely to the mineral wealth of the kingdom. Carnarvonshire and Merionethshire were the greatest slate-producing districts in the world, and Montgomeryshire, Cardiganshire and Anglesey were rich in lead and copper. The strata throughout North Wales were greatly disturbed, and the existing Ordnance maps were on that account almost useless for geological purposes.

The deputation begged, therefore, to urge strongly upon the Government the undoubted advantages in a national point of view which would result from the prosecution of the survey in question at the earliest possible date, of what would ultimately be a saving of expense, inasmuch as the trigonometrical survey could be carried on the base now worked upon in Denbighshire, and triangulation now going on there could, at a comparatively small expense, be extended over the whole of North Wales.

Lord Richard Grosvenor said he felt a great interest in the question, and thought the geological and mineralogical survey of Flintshire and Denbighshire would be incomplete if it were not extended beyond the limits of those counties. Mr. Osborne Morgan thought great benefits would result from going on with a survey already commenced instead of removing to a new district to start from a new base.

Mr. Stanley said that the Geological Society had already shown the importance they attached to the North Wales district by sending Professor Ramsay to survey and report upon the geology of that country.

Mr. Holland said the Crown had large possessions in North Wales which had never been properly surveyed.

Mr. E. M. Richards said he had observed in Glamorganshire and Cornwall the great advantages derived from an accurate survey of a mining district, and strongly urged the claim of the representatives of Wales to have their petition duly considered.

Mr. Ayrton said that the survey of the whole kingdom was a work that would extend for many years. He objected to a detailed survey on a large scale being executed at the expense of Government, and thought the populous districts of the kingdom who paid the bulk of the taxes had the first claim. However, the matter should be laid before the Surveyor-General, who would have to be consulted as to the progress of the survey. The surveys already in hand had been undertaken before his accession to office, and for his own part he doubted whether it would not be expedient to adopt some cheaper plan for the survey of the rest of the kingdom.—North Wales Chronicle.

#### THE ROYAL CORNWALL POLYTECHNIC SOCIETY.

The thirty-eighth annual report of this society has just been issued. The financial position has continued to improve during the past year, and the number of articles exhibited was considerably in excess of those in the former exhibition. The more important of these are referred to in papers which are appended to the report. A patent (valve) regulating gas and air blow-pipe, by Messrs. Cotton and Johnson, was described. The valves of these blow-pipes are constructed somewhat on the simple plan of an ordinary gas-cock, the difference being that the outside body turns and rotates in a line with the gas supply pipe, whilst the plug remains fixed; the valve can thus be adjusted with the finger and thumb whilst the blow-pipe is in use. There is a regulating slide to admit air to mix with the gas previous to its being burnt. The same manufacturers likewise exhibited a regulating flame torch-blowing lamp or acoplite. The improvement consists in varying the quantity of wick exposed by merely turning a small toothed wheel, which takes into another surrounding the wick slide.

The volume also includes papers on R. H. Williams's improved buddle; Duckham's hydrostatic weighing machines and dynamometers; Solomon's improved apparatus for taking photographs by artificial light; heliographic printing; Griffin's gas furnace for producing white heat without the blowing machine; Chatwood and Sturgeon's ore crusher; Dingley's pulveriser; boiler explosions in Cornwall, by E. B. Marten; Otto and Langen's atmospheric gas engine, &c. With regard to this engine it is explained that common illuminating gas is employed. Gas and air mixed in such proportions as to give an explosive compound are admitted under a piston which slides air tight in a vertical cylinder open at the top. The compound is ignited, explodes, and the explosion drives the piston upwards. The ignited gases having increased in volume lose their heat; their pressure becomes less as the piston rises, and by the time the piston has got to the top of the cylinder, an outlet for the waste gases having been provided, there will be a vacuum under it, and the overpressure of the atmosphere will make it descend. The work thus done yields the driving power, which is transferred to the shaft by suitable mechanism. The consumption of gas is regulated by the governor, which opens or shuts a valve in the exhaust pipe, thus allowing the piston to descend more or less quickly, and to make more or fewer strokes per minute. The more slowly the engine runs the smaller is the consumption of gas. The number of strokes in a stated time determines the power yielded by the engine, and is independent of the number of revolutions of the fly-wheel, which revolves always at the same speed, or nearly so, whether the piston makes thirty or only five strokes per minute. But with only five strokes the engine gives off only about one-sixth of the power which it would yield with thirty strokes. The concluding portion of the volume contains papers on a zoological miscellany, by W. P. Cockle, W. P. Cockle, and the zoology of West Cornwall, so that the book will prove a valuable work of reference.

\* "Royal Cornwall Polytechnic Society: The Thirty-eighth Annual Report, 1870." Falmouth: The Society.

KELLY'S POST OFFICE GUIDE TO LONDON IN 1871.—Until the publication of this work, the second edition of which has just been issued, London was really without a reliable guide book; but the preparation of one having been undertaken by Messrs. KELLY, who possess exceptional resources for the collection of the necessary data, the present volume is one which may safely be consulted by both visitors and residents. The compilation of it has, we believe, been entrusted to Mr. P. L. SIMMONDS, and the manner in which the task has been performed reflects great credit upon him. The first chapter, embracing an historical sketch of the rise and growth of medieval London, is particularly interesting, and the subsequent chapters describing London as it is are equally attractive. Whether information be sought upon the amusements, inhabitants, food, local government, religion, wealth, charities, architecture, or commerce of London, it can be at once obtained by referring to Kelly's guide. The book is, indeed, invaluable.

WESTERN CHRONICLE OF SCIENCE.—The May and June numbers of this interesting little periodical, edited by Mr. J. H. COLLINS, F.R.S., Secretary of the Cornwall Polytechnic Society, are fully equipped with the most valuable and interesting papers on the most important subjects in science. In the former number there is a paper on Scientific Mining, by James Williams, and the usual notices of books, &c. In the June number there is a description of Jordan's Improved Patent Amateur Carving Machine; a clever article entitled Mining in Outouge; an account of the Watcombe terra cotta; notices of books, &c.

CLEVELAND PIG-IRON TRADE.—Mr. C. E. Muller (Middlesbrough-on-Tees, June 16) writes—"Since my last report the market for Cleveland pig-iron has had rather an upward tendency. The heavy decrease in stocks during April and May have induced buying both for this and next year. Makers now hold out for the following prices:—No. 1, 52s.; No. 2, 48s.; No. 3, 47s.; mottled, 46s.; the Tees, 45s. The Tees, therefore, are higher than the others in the face of a still increasing make. Last month there were 118 furnaces in blast. This is the heaviest make yet reached, being 12 furnaces more than in May last year, and we continue to compare favourably with the corresponding months a year ago.

	Production.	Foreign shipments.	Coastwise shipments.	Warrant stores.
April 30, 1871	Tons 185,472	30,827	19,067	9,080
April 30, 1870	139,722	31,195	19,494	20,584
Increase	15,750	Decrease 368	427	11,545
May 31, 1871	164,082	44,775	22,168	7,889
May 31, 1870	141,829	29,682	14,610	18,534
Increase	22,253	15,113	7,558	Dec. 10,615
Stocks at May 31 were—Makers	97,863	against last year 68,910		
" " Store	7,889	" "		18,534
Total	105,753			86,648

Showing only 19,210 tons total increase. A year ago I noticed a deficiency of 12,000 tons between my returns of foreign shipments and those of the Ironmasters' Association. This year a similar difference occurs. My returns are as follows, made up from the highest authentic returns:—From Middlesbrough, 36,899 tons; Stockton, 2721 tons; Newcastle, 1985 tons; Sunderland, 1176 tons; East and West Hartlepool, 2114 tons; &c. The Association returns give the shipments from Middlesbrough only; their figures are 34,738 tons. Under the head of coastwise shipments the Association give May, 1870, at 14,610 tons. Their last year's report for that month gives May, 1870, at 21,223 tons. Whence this difference of 6600 tons? This year's statistics are, no doubt, a correction of last. The exports to Belgium, Germany, and Austria are unprecedentedly large this year. France, immediately after the conclusion of peace with Germany, gave orders for large quantities of iron. As the rise of the Communist Government at once put a stop to all business. As regards our future trade with France, it is impossible to speak with anything like certainty. The tariff is under revision by the Government, and it is feared that their financial necessities may induce them to impose a still higher duty on pig-iron. On such an indispensable article the prudence of such a measure seems to me very questionable, especially as France has lost in Alsace and Lorraine a large portion of her iron-producing power. Much difference of opinion exists as to the future course of prices, the contingencies are so various.—First, we have the usual decrease of shipments during Midsummer (a question to be decided in the next week or two)—the movement amongst the artisan classes in the North of England for restricted hours of labour, all pointing towards heavier stocks of iron. On the other hand, the miners want more wages, but it is a peculiarity of these men that the higher the rate of wages the less the output of ironstone, so that the furnaces may possibly get a short supply. Secondly, it seems to me that the influence of late political events on the money market is treated too lightly in this country. An event of such magnitude as the late Franco-German war, and the subsequent revolution, must have completely unsettled French industry and commerce in all their branches, and cannot but have a serious reaction on the money market. It is true that no direct pressure is felt as yet, but as soon as France gets settled again, and begins to put her house in order, I fear matters may not go on so smoothly as people seem to expect. It must not be forgotten that the great financial crisis through which this country has periodically passed can be traced to causes less severe than those just mentioned. The prospects of the harvest in France and Germany are very moderate, and this coupled with the enormous loans that have to be raised, must tend to raise the rates of discount. In France, Belgium, and the North and West of Germany the harvest will be bad, but in Russia and Hungary, on the other hand, the prospects are very good. These last-named countries are our best cur-



comers for rails, so we may set this off as at least one point in our favour. The rolling mills of our district are well supplied with orders. A large business is being done with Scotland and the Continent in puddled bars, which are now quoted at 6s. 6d. per ton. Plates are in great request at 8s. 17s. 6d. to 9s. quoted f.o.b. here at 6s. per ton. Pipes are in great request at 8s. 17s. 6d. to 9s. per ton; indeed almost all the shipbuilders in the North of England are full of work for this year. Rails are firm at 7s. per ton for Russian specification, and 6s. 10s. to 6s. 15s. for American.

### STEAM SHIPBUILDING—THE CLYDE.

THE NAPIERS, OF GLASGOW.

A Scotch contemporary gives the following account of shipbuilding on the Clyde, and the rise and progress of the celebrated firm of NAPIER and SONS:—

With the history of steam shipbuilding in Scotland, and particularly in connection with the development of this great national industry on the Clyde—which has now become the shipbuilding-yard of the world—there is one firm forming a connecting link between the past and present generation of steam shipbuilders—a firm closely allied with the great achievements that have taken place in marine architecture, the works of which might with propriety be termed the "Parent Steam Shipbuilding Establishment of Scotland," if not of the civilised world. We refer to Messrs. Robert Napier and Sons, Glasgow. A glance at the early history of this distinguished individual makes his future career all the more interesting, and his humble beginning in life makes the end the greater, and adds lustre to his time-honoured name. Robert Napier was born in Dumbarton, June 18, 1791; was educated in the Grammar School of his native town, and received what in those days would be considered a good education; but in addition to his teaching from that institution he was taught architectural and mathematical drawing from another source. His father was a blacksmith, and at the age of sixteen years Robert was apprenticed to his father to learn the trade, and in 1811 removed to Edinburgh, and wrought as a millwright. Let us here remark that a blacksmith in those days generally included both millwright and engineer (in fact, the last named at that period was a term not commonly used).

The Vale of Leven, around Dumbarton, was famous for millwrights in those days; and doubtless young Napier received much information among the public works in the district that sowed the seed of a rich harvest. However, in the year 1815 we find him, with capital amounting to 50s., in Glasgow, and with 45s. he purchased the goodwill of a blacksmith's business and tools. This investment proved successful. And again, in the year 1821, we find him engaging in engineering and ironfounding, and from this time his progress through life was that of success, honour, and distinction. About the year 1823 he made his first marine engine, for a small steamer that traded between Glasgow, Dumbarton, and Greenock. This steamer was built by James Lang, Dumbarton, and was named the Leven; her registered tonnage was 71, and the horse-power of the engine was 30. After an honourable career on the Clyde, and when her day and generation was gone, the engine was carefully taken out, and allowed to rest where it was made. To the curious in such matters, it is still to be seen at the works of Messrs. Napier and Sons, as a relic of the past in marine engines of a bygone age. Soon after this Mr. Napier's name as a shipbuilder became known over the whole world. He executed several large contracts for the East India Company, which performed the duties required of them in a manner alike creditable to builder and owners. He supplied the engines for the British Queen to ply to New York, and was one of those who subscribed towards the trial of the *Sirius*, the first steam vessel that crossed the Atlantic. In the year 1840 he formed conjointly the celebrated Cunard Steamship Company along with the individual who bears that name, Sir Samuel Cunard. The first four vessels for that company were built and engaged by Mr. Napier, and we know to what dimensions it has now reached—the number of their vessels may be put down as legion in the shipping world. Mr. Napier was first in everything appertaining to steam shipbuilding. Many improvements he introduced and patented in connection with marine engineering, and one which he laboured at long and hard, although never universally applied, deserves special notice—his attempt to introduce the rotary engine to propel vessels. This, in fact, he brought to perfection, but it was found inadequate for what it was intended.

In the year 1853 Mr. Napier took his sons into the firm, hence the name Robert Napier and Sons. In the same year he fitted up the engines for H.M.S. *Duke of Wellington*, the largest vessel at that time in the navy. But the greatest of all this enterprising company's contracts was the *Black Prince*, sister ship to the *Warrior*, built on the Thames, and of the enormous burden of 6100 tons. The difficulties to be overcome in launching such a ponderous mass of iron in the shallow waters of the Clyde were considered by some eminent individuals to be of such a nature that in all probability she would never be seen in mid-stream; and considering the amount of labour the *Warrior* cost on the Thames—which is a sea compared to our muddy Scotch stream—the launch of the *Black Prince* was considered in Glasgow to be an event only occurring once in the lifetime of a city. The population held high holiday on the occasion, and the hearty cheer that greeted the great ship when she left the ways, and was seen safe in the water, showed the interest the whole community had taken in the success of the launch. While the *Black Prince* lay in Greenock Harbour receiving her machinery excursion parties came from all the parts to visit her. Everybody who had an hour to spare, if in Greenock, had to go and see the *Black Prince*. In the year 1863 Robert Napier and Sons built the *Rolf Krake* turret-ship for the Danish Government, which did good service in the war between Denmark and Germany on the Schleswig-Holstein question. She was the first turret-ship engaged in actual warfare, and was quite up to the expectations formed of her. For the Turkish Government they have built three frigates, of 4221 tons each. Turkey has at present a much larger and stronger ironclad fleet than Russia, and any encroachments from the Czar that may threaten the frigates will be sure to give a warm reception.

One of the Messrs. Napier's latest constructions in war vessels was the *Hotspur*, for our own Government. This vessel was launched at Glasgow on March 19 last year, and was of rather novel construction, and something new in our navy. We will now take a cursory glance at the works of Messrs. Napier. It may be well to state that the works are divided into three distinct establishments—the shipbuilding yard at Govan, the boiler works in Washington-street, and the engineering establishment in Lancelfield-street. The shipbuilding yard at Govan covers ten acres of ground. The frontage to the river enables the firm to have as many as eight large vessels in course of construction at one time. The machinery department measures 100 yards long by 50 broad. There are plate and bar furnaces used for all the different material in a shipbuilding yard, such as for straightening and bending plates, setting angle iron, &c. The smiths' shop measures something like 150 ft. long by 40 broad, and contains upwards of 90 fires and six steam-hammers. It may be well to mention that in the machinery department alone there are over 100 smiths' fires. Several of the furnaces already mentioned are upon Gorman's patent gas regenerative principle. Within the Govan yard there is also a sawmill, a joiner's shop, and a moulding loft, where the full-sized outlines of a vessel of 5000 tons can be drawn on the floor; there is also a hydraulic press for bending iron plates, which is something of itself.

In the old Vulcan Works, Washington-street—which is now the boiler works, but formerly the scene of many triumphs in marine engineering—there is all that is requisite for boiler making in the shape of punching machines, shears for cutting iron, drilling machines, vertical and horizontal, some with only one drill working at a time, others on what is termed multiple principle (these machines can be worked with only one drill, or with a given number), steam riveting machine, tube expanders, and last, though not least, a planing machine for boiler plates; there are likewise a number of smiths' fires adapted to boiler work. There is something in the Vulcan that might interest the antiquarian engineer—a pattern store, containing the patterns of the firm for a great many years past.

Coming now to the Lancelfield Works, which is the engine department. Were I to attempt a description of the numerous turning lathes, from the largest down to the smallest, the slotting, planing, shaping, and cutting machines, verticals, boring mills, &c., that are within its walls I fear I should weary the patience of the reader. Suffice it to say that everything needful in carrying on an extensive marine engineering establishment is complete.

Although Messrs. Napier can no longer claim to be the largest shipbuilders on the Clyde, the firm will for ever live in the history of shipbuilding, and the late Mr. Napier's name is still held with reverence among the toiling thousands engaged in this great national industry. His establishments were an asylum to many an old man who would be denied employment elsewhere. Individuals of all ranks have paid his works a visit. Many of the nobility of other nations have surveyed them with interest; and although at the present time not so fully employed, owing to some misunderstanding, we hope that the time is not far distant when the old Vulcan will ring with the music of boiler-making, and see dragged from Lancelfield some of the huge cylinders and crank-shafts seen in former days.

One pleasing feature in connection with shipbuilding on the Clyde is, that never in its history was trade in a more flourishing condition than at the end of last year. The contracts in hand numbered 140 vessels, with a tonnage of 180,000, and only four of these were sailing ships; and considering the number of vessels contracted for during the present year, the work on hand without another order would carry well through the year 1872.

### COAL IN AUSTRIA.

We have not yet exhausted the data at hand with reference to coal mining in Austria. The production of pit or coking coal in the various provinces of the Austro-Hungarian monarchy is divided as follows:—

Province.	1860.	1865.	1869.
Bohemia .....	47.4	51.0	50.8
Silesia .....	22.8	19.6	21.2
Styria .....	0.3	0.1	0.1
Hungary .....	11.7	12.5	11.2
Moravia .....	10.2	10.7	11.0
Gallizia .....	4.9	4.3	4.3
Miscellaneous .....	2.7	1.8	1.4

As regards brown coal (or lignites, or coal containing a very large proportion of bitumen), the figures stand thus:—

Province.	1860.	1865.	1869.
Bohemia .....	41.7	44.1	47.5
Styria .....	22.9	22.9	23.5
Hungary .....	15.0	10.9	12.4
Moravia .....	2.9	5.8	2.6
Gallizia .....	0.5	0.1	—
Austria-sub-Enns .....	4.7	2.8	2.0
Austria-sur-Enns .....	2.7	0.1	—
Carniola .....	2.6	3.0	4.0
The Coast .....	0.8	1.0	0.9
Lombard-Venetia .....	0.5	0.3	—
Dalmatia .....	0.4	0.2	0.1
Tyrol and Borarberg .....	0.3	0.3	0.4
Croatia and Slavonia .....	0.2	0.5	—
Transylvania .....	0.2	0.1	—

The basins nearest to Prussia, Saxony, and Central Germany are those which are most rapidly developing their production. The extraction has, for instance, been as follows of late years in the mining district of Komotau-Teplitz:—1860, 450,018 tons; 1861, 535,538 tons; 1862, 579,427 tons; 1863, 643,190 tons; 1864, 706,944 tons; 1865, 785,748 tons; 1866, 697,155 tons; 1867, 927,777 tons; 1868, 1,077,015 tons; and 1869, something over 1,450,000 tons. Of these 1,450,000 tons, 1,190,970 tons were exported by the Teplitz, Aussig, and Dresden Railway. The coal traffic on this line amounted in 1861 to 272,170 tons, and in 1869 it had risen to 1,190,970 tons. The coal of the district is carried via Aussig to Dresden, Leipzig, Berlin, Magdeburg, and the whole of North Germany. In 1869 it was carried as far as Eisenach (on the Leipzig and Cassel line), Vienenburg (on the Leipzig and Brunswick line), Halmersleben (on the Magdeburg and Goslar line), Stendal, Wittenberg, and Hamburg (on the Berlin and Hamburg line). At Eisenach, Vienenburg, and Halmersleben, Komotau-Teplitz coal competes with the coal of the Ruhr; at Cassel it meets the coal of the Saar; and at Hamburg it is little by little replacing English coal. In Austria, again, Komotau-Teplitz coal penetrates as far as Olmutz and Brunn, as its cheapness and abundance enables it to compete with the coal of Silesia and Moravia. The Pilsen coal, through the approaching opening of the Francis-Joseph Railway from Vienna to Eger, and the fine gas coal of the Elbbogen district, through the recent opening of the line from Eger to Karlsbad-Komotau, will also be now exported, and will secure to Northern Germany all the coal supplies which it now requires. When the railway companies reduce their tariffs the coal traffic of the Austrian and German lines will doubtless assume immense proportions, and Germany will be one of the best coal-supplied countries in the world. In Austria itself, although the country is very rich in coal deposits, there have been frequent coal famines, in consequence of the general increase in the demand, the progress of industry, and the imperfect systems of working adopted. At Vienna, the third city in Europe in respect to population, a coal crisis assumed last winter such proportions that the Communal Council ordered a public enquiry in order to endeavour to remove the disastrous consequences of the periodically recurring coal difficulties. The gentlemen engaged in the enquiry reported their opinion to the effect that the most efficacious remedy which could be adopted to remove the evils complained of would be a reduction in transport expenses, and an augmentation in the means of production.

As regards the progress of coal mining in the various German states composing the Zollverein, it has been very rapid of late years. In 1860 the production was 12,347,828 tons; in 1861, 14,133,084 tons; in 1862, 15,576,278 tons; in 1863, 16,906,707 tons; in 1864, 19,468,982 tons; in 1865, 21,794,705 tons; in 1866, 21,629,746 tons; in 1867, 23,738,327 tons; in 1868, 25,704,758 tons; and in 1869, 26,774,368 tons. Comparing 1869 with 1860, we have thus an increase in the production of no less than 117 per cent.

### MINING IN GREECE.

Greece has some mining resources, though the great mineral countries have always been outside Greece proper, in what they called the barbarous regions of Macedonia and Thessaly, now held by the Turks, and which the Greeks very readily claim as a part of Greece. It was hoped some time ago that at last the unhappy country of Greece was to benefit by European enterprise, as a railway was to be constructed between Athens and the Piræus, and the silver slag of Laurium to be worked, and there was a prospect of draining some of the lakes and marshes. The history of auriferous has, however, now taken a turn which is likely to check investment in Greece for some time, coming as it does in succession to brigandage and the ruin of the Ionian Islands. A great source of wealth to the small but powerful republic of Athens was the silver-lead mines of Laurium, which may now be described as opposite the island of Makronisi, past Cape Sunium, and within six hours steam from the Piræus. The Athenians worked these mines for centuries by means of slaves, and their produce is attested by the vast beds of slag now on the spot, and the great diffusion of Athenian coins. In Egypt the silver coinage must have been mainly supplied from the mint of Athens, for the pieces, with the well-known owl upon them, are dug up by hundreds now, and are a drug in the coin market. We may mention as a curious circumstance that there was a pamphlet written by the famous XENOPHON on these well-known mines, and which gives some particulars with regard to them.

The working ceased for ages, when some few years ago a Frenchman, named ROUX, visited Laurium, we believe about 1864, and he discovered, as was natural, that the ancient Greeks had left large quantities of silver in the slags, and that these were capable of profitable reduction. He, therefore, bought the slag beds of the villagers who had acquired the legal title since the war of independence. He then entered into partnership with an Italian, named SERPIERI, and obtained a concession from the Greek Government, authorising the working on a royalty of 25 drachmas, or about 1s. per metric ton of lead extracted. The new company accordingly began operations about that year, and it was necessary to drain a marsh which was formed. They set up smelting furnaces, with the requisite machinery, formed a troop of carrying mules, and introduced competent workmen. The enterprise was successful, and beneficial to the country; and one evidence is the creation of the village or town of Ergasteria, or "The Workshops," with about 3000 people. The undertaking increased so that, in the year 1870, no less than 8000 tons of refined lead was exported from Greece. The produce of silver we have not ascertained, but we have seen it rated at 10 lbs. per ton.

In the usual Greek style, with their accustomed antipathy to foreigners, instead of being rejoiced at the benefits conferred on their country, the Greeks began to scheme to deprive the foreigners of the enterprise, when found to be profitable. In 1869 the Government appointed a committee to examine the Ergasteria district, and it reported that the beds consisted of 6,000,000 tons of slag, and that reckoning the profit at 20 drachmas per ton, the foreigners would carry out of the country a profit of some 5,000,000. It may be believed that there was a universal cry in the press that the State should be put in possession of this treasure. The Government was, however, afraid at that time to confiscate the property, and contented itself with requiring that the royalty should be raised to 50 drachmas per ton of lead exported. The company fought against this, but fearful of resisting altogether, it consented to a modification under which the royalty became payable on the regulus instead of upon the refined metal. This, however, was not accepted, and the authorities actually put the works under what was called a temporary sequestration, until the points at issue between the Government and the company were adjusted.

The company applied to the French and Italian legations, and, supported by them, instituted a process against the Government in the District Court, and obtained judgment against the Government there, and in the Court of Appeal. The Government then applied to the Chambers, and this iniquitous legislature has pronounced the annulment of the concession, and decreed that the slag beds of Laurium shall be apportioned in lots, and sold by public tender for the profit of the territory.

This is the last news we have of this once fortunate and now luckless undertaking; but we presume the Italian Government, which is acquiring great power in the East, and seeking to recover its ancient prestige there, will not allow the matter to drop, and it is not without the military power or disposition to enforce a just claim. In the meanwhile, and whatever may be the compensation to Messrs. ROUX and SERPIERI, this transaction will have a deterrent effect on foreign capitalists. It is but lately that the great English agricultural enterprise in the island of Eubœa received a fatal blow, from the son of the proprietor being incarcerated on the charge of complicity in the murder of our fellow-countrymen by negotiating for their delivery from the brigands. Although this gentleman was released from this outrageous persecution by the intervention of our Government, he took warning as to the parties he had to deal with. All these things are to be deplored, because an interesting country in Europe is withheld from the beneficial operations of European enterprise.

### THE MINERAL WEALTH OF AUSTRALIA.

We are again indebted to the Secretary for Mines, Mr. R. BROUGH SMYTH, for his valuable statistics for 1870 of the mineral produce of Victoria. Compared with the returns for the previous year the position of the mining interest in the colony appears to have improved, the amount of Chinese labour employed has somewhat diminished, and the average earnings of the miners has increased to the extent of about 2s. per annum. The importance of the publication of the returns is recognised alike by mine owners and miners throughout the colony, and the necessary information for preparing the statistics is given with the utmost willingness. On giving a promise that the figures furnished by them shall be massed with others, and used only for public purposes, they with rare exceptions unhesitatingly place their books before the officers of the department, and some of them even take the trouble to supply the results in such a shape as to admit of their being filled into the tables at once. The mining surveyors and mining registrars have exerted themselves in a commendable spirit, and the form in which their returns are prepared permits of any discrepancy calling for explanation being seen at a glance.

The quantity of gold exported in 1870 was 1,222,798 ozs. 3 dwts., against 1,340,838 ozs. 8 dwts. in 1869. This decrease of 118,040 ozs. 5 dwts. in the exports, large as it is, is not so large as might have been expected. The damage done to claims and mining plant by the heavy and unprecedented floods which occurred on the gold fields several times in the year 1870, the interruption thus caused to mining operations, the decrease in the number of miners, and the falling off in the yield of gold from several of the deeper alluvial mines are sufficient to account for a large decrease in the exports. The quantities of gold purchased by bank managers and gold buyers on the gold fields were—from alluvial workings, 718,729 ozs. 8 dwts.; and from quartz veins, 585,575 ozs. 18 dwts.; showing a decrease of 215,353 ozs. 8 dwts. from the alluviums, and of 25,098 ozs. 14 dwts. from the quartz veins. It is probable that the gold got from quartz veins, as given by the banks and gold buyers, represents very nearly the total produce. It is not practicable at present to apply a similar check to the estimates of the produce of gold from alluviums. The number of miners employed in getting gold was 59,247 on Dec. 31 last, being less by 4540 than on Dec. 31, 1869. Dividing the value of the gold exported during 1870 amongst the mean number of miners employed, the average earnings per man for the year were 81s. 6d. nearly, whilst in 1869 the average was 79s. 7d. nearly.

The estimated total value of the machinery and mining plant employed on the gold fields on Dec. 31, 1870, was 2,128,896s., showing an increase, as compared with the estimate for 1869, of 20,227s. In alluvial mining 403 engines are employed, of 9915-horse power in the aggregate; in the previous year the aggregate horse power was 9650. In quartz mining there were 711 engines, of 13,572-horse power in the aggregate, and in the previous year they were using 12,796-horse power in the aggregate. The revenue derived directly from the gold fields and mineral lands, exclusive of fees, fines, and forfeitures, was 38,494s. 9s. 6d. The information collected by the mining surveyors and mining registrars from millowners and others relative to the yield of gold from certain parcels of quartz crushed shows that 908,526 tons of quartz yielded at the rate of 9 dwts. 21.05 grs. per ton. Up to Dec. 31, 1870, information has been received respecting the yield of gold from 7,603,619 tons of quartz, and the average per ton is 11 dwts. 4.57 grs. It seems that less gold is permitted to escape with the tailings than formerly, for in 1870 the average yield obtained from the tailings was but 2 dwts. 16.79 grs. per ton, whilst the average, taking the period from 1864 to 1870, was 3 dwts. 21.01 grs. The auriferous pyrites and blanketing operated upon in 1870 averaged 2 ozs. 13 dwts. 11.42 grs. per ton. The highest price paid for crushing quartz and cement is 30s. per ton (which is in some parts of the Gippsland district), and the lowest 2s. 6d. per ton (in the Castlemaine district).

Too much importance can scarcely be attached to the question of the supply and use of timber for mining operations, since it seems probable that unless immediate steps be taken to provide a remedy for the present waste the gold fields will become valueless, not from absence of auriferous mineral, but from the same cause that has rendered the valuable iron deposits of Sussex worthless—the consumption of the materials necessary for the profitable working of the mines. Just as in Sussex the iron industry was extinguished by the improvident consumption of the timber used for fuel, so the gold mining industry of Victoria will, it may be anticipated, be extinguished by the improvident use of the timber required by the miners. The mining surveyors' and mining registrars' estimates of the quantities of timber used in the several districts show that no less than 444,886s. were paid by the miners for timber for their mines and for firewood during 1870. This enormous outlay is rendered necessary partly because of the carelessness of woodcutters and others who invade the forests, and in felling trees destroy nearly as much as they take away, and mainly because no efforts have been made to replace the native trees by other quick-growing foreign sorts. Year after year, as Mr. SMYTH remarks, attention has been directed to this matter, and if steps be not taken promptly to plant the large areas of ground lying adjacent to the principal mining centres great loss to the country will follow, as surely as wilful extravagance in an individual leads to poverty. Those who have watched for 10 or 12 years the rapid growth of many foreign trees in the colony know how cheaply and easily the forest lands could be made to yield an abundance of timber for firewood, and a large quantity suitable for laths, slabs, &c. The report, dated December, 1867, of the commission appointed to enquire into the condition of the State forests should now receive the attention of local bodies, if any attempts are to be made to prevent the stoppage of works on many extensive leads, where the



profits are at present barely sufficient to induce the mining capitalists to continue their operations.

The scientific education of miners appears to be receiving a fair amount of consideration. At the examinations for mining surveyors four gentlemen presented themselves during the first quarter, and three passed; during the second quarter two out of six passed; during the third quarter three out of six; and at the last examination three presented themselves, and two passed. It was stated in the previous report that there was a prospect at that time of the proposal for the delivery of lectures on subjects connected with mining being favourably entertained, but up to the present time no reply has been made to the letters asking for the use of a room. The lecturers offered their services gratuitously, and on the distinct understanding that as soon as the foundations of a mining school were laid, and other lecturers could be found to take their places, they would resign. The common notion, as Mr. SMYTH remarks, that practical mining can and ought to be taught in a school of mines, and that the instruction that would be given in such a school should stand in lieu of practice in mining works, is, it is needless to say, erroneous. Only in a mine, and in the midst of mining works, can the student obtain that technical knowledge without which all that he can learn in a mining school is valueless to him in his profession. It was intended to add to the knowledge of the practical miner, and to encourage him to study those branches of science which are almost indispensable aids to practice, but which cannot stand as substitutes for it. It has, moreover, long been acknowledged that any sanguine anticipations of great success, and any strong hopes that immediate beneficial results would follow, would in all likelihood be disappointed. Mining schools in Europe have done much good, but the scholars have not taken the places of practical men without scientific training, to whom invariably the control of all the larger mines and mining and reducing works is entrusted.

The mineral collection at Melbourne will probably rank amongst the most important in the world, for it appears that even during the year reported upon the groups of minerals, rocks, and fossils added to the collection of the mining department number more than 800. In the mining for metals other than gold there were but 248 miners employed, of whom 133 were tin miners. No silver ore was raised during the year. Of tin there were exported during the year 146 tons 16 cwt. of tin ore, and 1680 lbs. of tin. There were 11 tons of copper ore exported, but none is reported as having been raised during 1870. Of antimony ores there were raised 1661 tons 3 cwt., and there were exported 1052 tons 16 cwt. of antimony ores; 64 tons 8 cwt. regulus, and 171 tons 9 cwt. of antimony. About 100 tons of lead ore was raised; in addition to which there were 100 tons of coal, 532 tons of lignite, 2650 tons and 160 square yards of flagging, and 10,000 slates. The value of minerals other than gold was \$7,871.

The CENTRAL CITY MINING COMPANY has been formed, and the capital entire subscribed by several influential members of the Stock Exchange, for the purchase of an extensive mineral property situated at Central City, Colorado Territory, U.S. The condition of purchase is that the statements made as to its value and the profits it will yield are confirmed by competent authorities selected by the purchasers. It is situated in the centre of the gold and silver producing region discovered in 1859, and consists of 600 feet in length on the Illinois lode and 800 feet on the Confidence lode, a plot of ground 250 feet in length by 145 feet in width, with buildings, mill, and machinery thereon, and being on the Illinois lode; also another plot of ground, 250 feet square, upon the Confidence lode. The title is absolute, having been unconditionally granted by the Government under the Law of Congress enacted in 1866. The Illinois vein is between granite walls, giving evidence of strength and durability, and is unquestionably a true fissure. The vein gauge is 4 feet wide, and usually encloses a body of solid ore from 2½ to 4 feet in thickness. For the entire distance traversed by the main level, 150 feet below surface, the vein has been found uniformly rich in the precious metals. In the second level, 50 feet below the first, very rich ore has been struck, and at the date of the last advices the ore from this level exceeded in richness that taken from the upper portions of the mine. The Confidence lode has not been extensively worked, but sufficient has been seen of it to attest the presence of a rich and permanent vein of ore, in general appearance and quality strongly resembling the Illinois. The surface improvements are described as first-class, and are stated to have been constructed with regard to the future development and enlarged workings of the property. Railway communication has been extended to Golden City, 24 miles distant from the mines, and the line will be finished to Central City within a few months. In the meantime, the mines are accessible by good wagon roads. On an average from the entire vein the ore yields from 15¢ to 25¢ per ton; the mines as already opened will produce from 20 to 30 tons per day, and when fully developed the daily yield will be largely increased. At 20 tons per day, of the value of 15¢ per ton, there will be a yield of 90,000, for 300 working days. Estimating the aggregate expense at 50 per cent. (which is 10 per cent. of the actual cost) the net annual income is computed at 15,000.

**SUCCESSFUL APPLICATION OF MACHINERY IN MINING.**—We use steam extensively in hoisting, pulverising, and concentrating ores, but hitherto have depended almost entirely upon hand labour for running tunnels and drifts, and breaking down the ore. The Diamond drill tunneling machine, however, has been tried at Smartsville with success, and we may now consider it an important aid in the development of our mineral resources. It will henceforth be in constant and increasing use unless superseded—and that does not now appear probable—by some superior machine. The Blue Gravel Hydraulic claim, at Smartsville, is one of the most valuable and best managed pieces of mining property in the State. It has yielded at least \$1,000,000, and is expected to yield much more. The company, while washing off the upper strata of the claim, have at the same time been cutting a deep tunnel through which to run off the lower strata. The lower tunnel was cut 1285 ft. by hand, at a cost of \$10,000, and three years labour. When in 1867 ft. eight men were constantly employed in it, working in three shifts, and making about 1 ft. in 24 hours, at a cost of \$40 per foot, blasting with black powder. The whole length of the tunnel was to be 1563 ft., and as it would be an important point to hasten the work the company determined to try the Diamond drill. A machine was made for them in this city on the original pattern, and after many delays incident to the introduction of a new method of working, the experiment is pronounced a success. Fifty feet of tunnel have been made with it, and now that everything works smoothly, and the company have sufficient experience to judge of the extent of the work they declare themselves satisfied. In the same kind of rock which before cost \$30 per running foot, with black powder for cutting the tunnel 6 ft. wide and 8 ft. high, by hand, at the rate of 1 ft. per day, they now cut from 2 to 2½ ft. per day, in a tunnel 6 ft. wide and 9 ft. high, at an expense of \$25 per ft. This price covers everything save the interest on the cost of the machine and the wear and tear. The power is supplied by a 15-horse power steam engine at the mouth of the tunnel, and is transmitted by compressed air through a hose to the drills, which bore holes ½ in. in diameter, at an expense of 1¢ 1½ in. in the mine. The holes are usually from 20 to 30 in. deep, and all on the face of the tunnel are blasted out at the same instant by an electric exploder.

The chief profit at the Blue Gravel Mine from the use of the machine is in the saving of time. The tunnel, which has already cost \$40,000, would be of no use for 10 or 11 months yet if the drilling were done by hand, but with the help of the machine it will be ready for surface in less than four months. Here is a saving of an interest on \$40,000 for six months. Then the company will get their gold dust from the mine six months sooner, and they will have so much more interest on that. They have other tunnels to cut, and for the purpose of working to the best advantage they have purchased the machine now in use, and ordered another. They authorise us to say that in their opinion when the men have more experience, and when everything is arranged for the machine in the best style, it will do much better than at present.

The success of the machine in this tunnel implies a success in any tunnel of equal size in hard rock. The larger the tunnel and the harder the rock the greater the relative saving. We presume that there would be no economy in using a machine to cut a tunnel smaller than that at Smartsville, and that is larger than most of the mining tunnels used to be. Railroad tunnels are larger, and for them the machine is very valuable. Whether the Diamond drill could be used profitably in stopping or breaking down quartz rock is a question upon which we are not prepared to express an opinion, but which is worthy of examination.—*Daily Alta California*, San Francisco, May 30.

**CALIFORNIAN NEWS.—Two Thousand Dollars Per Day.**—At the Greene's Mine, between Auburn and Ophir, two and a half days' crushing last week, with four stamps and one Heburn pan, realised 185½ ozs. of retorted gold. This is at the rate of \$1987 per day, and gives a total of about \$28,000 within the past month. A local paper of May 6 says—Mr. Wm. G. Greene got his new 4-stamp mill and one Heburn pan to work last week, and run through 12 tons of ore, which yielded some \$14,000 in melted gold—over \$1100 to the ton. This is the most astounding yield we have ever chronicled, and we doubt if it has ever had its equal from the same amount of gold-bearing quartz. Another new pan will arrive this week, and when everything is completed it is expected that 10 or 12 tons of ore per day will be worked. There is now on the dump at the shaft 100 or 200 tons of ore, fully half of which is rich. This mine has been extensively prospected by shafts and drifts; and all the expenses, including the mill, pans, and machinery, have been met by running small portions of the quartz through an arrastra occasionally or panning out gold in a hand mortar. The following is the shipment of bullion by Wells, Fargo, and Co. from Washoe for the quarter ending March 31:—The shipment for January was \$50,446-33; for February, \$921,267-38, and for March, \$871,836-35, making the total sum of \$2,053,449-86. The Nevada County Assessor's statement for the quarter ending March gives—Tons of ore worked, 7204; amount of bullion produced, \$997,449; average per ton, \$90-92. The Record thinks that about \$500,000 was lost for want of Stetefeldt furnaces; since with them 65 per cent. of the silver could be saved, instead of 50 per cent. as now.—Wells, Fargo, and Co. shipped, on May 12 and 14 by way of Salt Lake, bullion valued at \$11,717-00. On May 17, for Barnum W. Field 9 bars, valued at \$7222-02; for Meadow Valley, 5 bars, valued at \$6099-83; for Raymond and Ely Co., 8 bars, valued at \$12,308-16.—total, \$26,328-99.—The Richmond Company, on May 17 made one tap of bullion

weighing 5028 lbs., which when assayed gave a value of \$1614-52 per ton. We saw, at the Empire Mine of the Phoenix Company, a solid piece of ore 5 ft. 6 in. in length, 3 feet wide and 20 in. thick. A piece had been taken from each corner and assayed, and it gave a result of \$268 per ton.—At Chollar Forest during the week 1670 tons of ore were extracted, and 1460 of which, assaying \$25-26 per ton, sent to the mills. During the week they shipped \$67,000 in bullion. At Colorado the Baker Mine is producing \$175 ore; the Klwington, Republican Mountain, is producing very rich ore; our mills are constantly and fully supplied with ore; the Stewart Reducing Company have shipped since our last issue, silver bullion, \$3821-62; the Briggs Mine is producing a good quantity of rich ore. The machinery for the Arroyo furnace has arrived; several rich discoveries are noted during the week, all by poor men; Palmer and Nichols' Reduction Works have as much work as they can do. Total bullion shipment for the past week by this company is \$3924; work on the O. K. lodes goes on, and rich mineral is found; ore from the College lode gave 232 ozs. per ton; the Barleigh Tunnel has cut another vein further in; it is a 4-ft. crevice. The ore assays 65 ozs. of silver per ton.—Wells, Fargo, and Co. shipped from Idaho this week 7 bars of bullion, valued at \$17,203.—In Silver City, New Mexico, several new and rich discoveries of silver-lead have been made in this vicinity. Workmen in an extension of the legal tender lode have struck ore of fabulous richness, and yesterday similar ore was found in a new lode between this and Chloride district. Numerous small furnaces (on the Johnson place) are being erected in every direction, and a considerable quantity of silver is being taken out daily by the Mexicans who run the only smelting furnaces now in operation. Work will soon be recommenced in the Chloride district. Among the richest lodes are the Providencia, Belknap, Adelaida, Red Rover, and Gran Tesoro, as also the Seneca. About the most extensive lode yet discovered is the Princeton, situated between this district and Chloride. This lode is nearly 40 feet wide, and crops out 10 feet high above the ground. The mine has not been worked as yet.—S. F. Mollitor publishes a certificate of assay made by him of ore from the Algonquin lode on Flint Creek. The gold coin value per ton showed \$6472-04. ARTESIAN WELLS.—A Watsonville correspondent of the *Alta* gives the following as the cost of sinking artesian wells at that place:—Boring, first 50 feet, 50 cents per foot; second 50 feet, \$1; third 50 feet, \$1-50; fourth 50 feet, \$2; and so on in proportion to the depth. Pipe for the well costs 75 cents per foot. A well 150 feet deep will cost, including incidental expenses, such as breakage in pipe, &c., about \$475.—*Scientific Press* (San Francisco).

#### FOREIGN MINING AND METALLURGY.

The condition of the Belgian coal trade is considered to have improved. Deliveries have been more easy, and abundant in all directions, and orders have flowed in to such an extent that a profitable season is anticipated. These orders have come from almost all quarters.—Germany, Holland, and France, especially the latter country. All kinds of coal are generally in good demand, and there is little doubt that the considerable stocks of coal which now exist at the pits' mouths will be rapidly disposed of. Prices are firmly maintained, and the collieries are working with serious activity. Railway rolling stock makes default to a less extent than hitherto, although the coalowners are still far from being accommodated in this respect as they could wish. The imports of coal into Belgium in the first three months of this year are returned at 41,107 tons, as compared with 51,032 tons in the corresponding period of 1870; the imports of coke in the first quarter of this year were 441 tons, against 2456 tons in the corresponding period of 1870. The exports of coal from Belgium amounted in the first quarter of this year to 277,122 tons, against 266,115 tons in the corresponding period of 1870. The aggregate exports for the first quarter of this year were, however, only 537,210 tons, against 886,184 tons in the corresponding period of 1870. The exports to the Zollverein and the Low Countries considerably increased in the first quarter of this year; but, on the other hand, the deliveries to France were only half what they were in the corresponding period of 1870. The aspect of affairs has now, however, so much improved that discouraging statistics will probably soon become matters of the past. The exports of coke from Belgium in March amounted to 31,690 tons, against 65,828 tons in March, 1870; and in the first three months of this year to 84,627 tons, against 179,043 tons in the corresponding period of 1870.

Since the conclusion of the definitive treaty of peace the condition of the iron trade in the Essen (Prussia) district has much improved. Confidence is returning, and prices display an upward tendency. Orders are arriving at the works so freely that almost all branches of metallurgical industry are actively occupied; the manufactories of machines and the foundries have especially most work. They have, indeed, a sufficiently assured amount of employment to enable them either to refuse new orders or to stipulate for long periods for their execution. The rolling-mills producing rails are not in so favourable a condition, as railway directors still show hesitation in giving out orders; nevertheless, the railroads are assured employment for some months to come. New lines which have been projected promise, besides, considerable orders in a short time. Several steelworks in the Essen district are enlarging their establishments, because it is certain that this branch of industry will rapidly develop itself, many railways now only employing cast-steel rails. The market for merchants' iron has been tolerably animated in the Essen group, and manufacturers are anticipating an advance in prices in the second half of this year. Prices of coal and coke have slightly given way, but are still very high. The Cologne Company for the Construction of Machinery will pay, July 1, a dividend for 1870 at the rate of 10 per cent. per annum. The Vulcan Company (Stettin) for the Construction of Machinery will also pay a dividend, July 1, on its original shares at the rate of 37s. per share.

The Belgian iron trade continues to present a favourable appearance. The demand is abundant for plates, iron, and pig, and a rather marked improvement is noticed as regards rails and rolled iron. Nevertheless, as according to the aspect of the German and English markets, the activity in affairs may easily become more marked, and may result in an advance in prices, foremasters do not readily consent to enter into long-term engagements. The state of affairs would be excellent in every respect but for the disappointment experienced in reference to the Athus and Givet Railway—that is, the refusal of the Belgian Government to concede such a line at present. Official returns show that the imports of minerals and limailles into Belgium have rather considerably fallen off this year, having amounted in the three months ending March 31 to 131,393 tons, against 147,659 tons. The imports of rough pig and old iron into Belgium in the same periods were 14,976 and 20,805 tons respectively. The exports of minerals and limailles from Belgium amounted in the first three months of this year to 24,604 tons, against 38,712 tons in the corresponding period of 1870. The exports of rough pig and old iron were 5854 tons, against 1474 tons in the corresponding period of 1870. The exports of rails from Belgium appear to be increasing, having amounted in March to 7040 tons, against 9180 tons in March, 1870; in the first three months of the present year they only amounted, however, to 8411 tons, against 22,594 tons in the corresponding period of 1870, showing a deficit this year of 14,183 tons. The exports of plates in March were nearly the same as in March, 1870, but the aggregate total for the first three months of this year shows a falling off of more than 1600 tons, as compared with the corresponding period of last year. The exports of iron of all other kinds were 7112 tons in March, against 8240 tons in March, 1870, while for the first quarter of last year there was a deficit of more than 4000 tons. The aggregate exports of iron of every kind from Belgium, exclusive of minerals and limailles, amounted in March to 22,231 tons, against 21,595 tons in March, 1870. On the other hand, the aggregate corresponding exports from Belgium were only 36,870 tons in the first quarter of this year, against 51,547 tons in the first quarter of 1870. These totals were made up as follows:—

Destination.	March, 1871.	1870.	1870.
Russia .....	1,277	2,153	2,884
Zollverein .....	8,135	14,723	14,551
Low Countries .....	4,143	6,663	5,246
England .....	1,904	2,899	2,321
France .....	589	1,928	10,849
Italy .....	319	327	3,923
Austria .....	3,110	4,055	741
Turkey .....	291	418	4,181
Egypt .....	—	—	1,321
United States .....	1,430	2,200	2,390
Miscellaneous .....	1,033	2,168	3,882
Total .....	22,231	56,870	51,548

In respect to value the exports for the first three months of this year presented a diminution of 112,9667. The Herve-Wergifosse Collieries Company will pay, July 1, a dividend of 14 16s. per share.

The tendency of the Havre copper market has been favourable. Every day brings more and more orders, and business is regaining little by little its habitual current. Some 20 to 25 tons have recently changed hands, at 69½ to 70½ per ton. Refined Chilean in ingots is quoted at 78½ to 80½ per ton, and pure Peruvian minerals 71½ to 72½ per ton. United States, Baltimore, and Lake Superior copper continue to make default. At Marseilles an advance has occurred in

copper; Toka and Spanish are quoted at 70½, and refined Chilean and Peruvian at 72½ per ton. The German copper markets display favourable tendencies; at the same time, it is right to say that the advance upon these markets has made less sensible progress; business has also been interrupted by the great military fêtes. At Hamburg prices have remained about the same, although the market, under the influence of more favourable advices from England, has acquired more firmness. At Rotterdam copper has experienced no variation. Tin has not yet revived upon the Havre market. At Marseilles, however, quotations have been better maintained; Banca has even advanced in price to 144½ per ton, and English to 150½ per ton. At Rotterdam tin has been in very great demand, and prices have experienced an advance; 77½ fls. has been paid for Banca; Billiton wholly makes default. There are no great transactions to report in lead. In Germany the article is quiet, at former rates. At Rotterdam, Stolberg and Eschweiler have been quoted as hitherto at 11 fls.; and German lead of various marks has brought 10½ fls. At Marseilles zinc in plates, re-cast, has brought 19½ fls., and rolled zinc 28½ per ton. On the German zinc markets there is no important change.

#### FOREIGN MINES.

**AUSTRALIAN UNITED (Gold).**—The directors have received, by the Southampton mail, a letter from Mr. Kitto (April 23). "Our last crushing (Duke of Cornwall) gave us 7 dwts. to the ton, and the present one looks equally promising. It will not take long to get us out of our pressing difficulties if the continues, and it has every appearance of it. The tributers at the Central are working hard to drain the deep ground. I hope they will have funds and pluck to hold out until it is drained. The first fortnight gave them 15 ozs. 13 dwts., and the present 38 ozs. 18 dwts. Did I inform you that the first lot of tributers obtained nearly 7000 worth of gold? This gives 35000 worth (about) from an infinitesimal portion of the ground."

**BIRDSEYE CREEK (Gold).**—The directors have received the following telegram:—"Have cleared up Neece and West claim after a run of 16 days—profit, \$1000 (2000). Have fitted up 'Uncle Sam' claim, and commenced work."

**SWEETLAND CREEK (Gold).**—(Telegram)—"We have cleaned up after a run of 46 days. The gross returns are \$17,000. The profit is \$9000. I send you a remittance of \$2500 (17000), 31 days' washing. The cost on account of new tools has been \$300 for the month."

**SOUTH AUSTRALIA (Silver).**—The directors have received, per steamer Hansa, three bars of silver from their mines, valued at \$3491-83; and by the steamer Deutschland three bars of silver, valued at \$3538-36.

**EBERHARDT AND AURORE.**—The directors have received, by the Algeria, 17 bars silver (40000 l.), from the Ouzis Mill.

**BATTLE MOUNTAIN.**—Captain Richards, May 25: Virgin: In the 113 ft. level, north of Hallow's shaft, we are driving towards Moore's winze, with a view of proving the lode and getting ventilation. In the 73 ft. level north the lode is producing fine rocks of ore occasionally, all of which, per assay made, produced 77-85 for copper, and looks as if an entirely new bunch of ore may be looked for in this direction. In the step in the back of this level (Jack's step) the lode is of large size, and producing a fair quantity of ore. The lode in the step in the back of the 113 is of large size, and very thorough.—Lake Superior: Pryce's shaft has been temporarily suspended, and the men are driving 113 north, at Virgin. In the 70 ft. level south the cross-cut has been met with, and we are driving through it as fast as we can, and hope to find the lode in the proved on the other side thereof. Ore shipped at San Francisco, 3838 sacks; on hand, 290 sacks.

**ECLIPSE (Gold).**—The directors have received a letter dated May 26 from the manager of the mines, stating that owing to difficulties still experienced with the atmospheric stamp-mill we were not getting on so well with the stamping as could be desired. He adds—"We are progressing finely with our new mill, but I did, or rather could, not push on as fast as I desired on account of this steam-mill bothering me so; in fact, it kept nearly every man in his place hard at work to keep it in repair, and so every branch of our surface works have gone behind and to enable us to keep the mill going. I have six good carpenters work on the mill. We are putting in the gates in the mouth of the ditch at the river to-day. The ditch will, I am promised, be finished in three weeks. I have told you heretofore of the great improvement in sinking the last (say) 70 ft. of Haymen's shaft. In due time we commenced to drive north on the lode (7 to 8 ft. wide). We had a good lode at the commencement of this level, but at about 10 ft. further in we got into a run of ground producing gold visible in one half of every bit of quartz we take in hand, and at least five times larger gold. One night, a week ago, the miners picked up a power-barrel full of first-rate stone to show me in the morning. I now send you a box of the best material, it is the best we have to date. I am saving the quartz from this level to be crushed by itself, so that by the next mail I will make a full report, and tell you the yield per ton. Six days ago I picked up a few handfuls of the smalls of the heap of 10 tons lying in the bottom of the bottom tunnel, brought it home, and panned half of it; it looked splendid. I then sent the remainder to Messrs. Balfour, Guthrie, and Co., with a request that they should telegraph you the result. Those smalls were not selected."—[The telegram from Messrs. Balfour, Guthrie, and Co., under date June 5, has, no doubt, referred to the result alluded to.]

**PACIFIC.**—Henry Prideaux, June 2: The ground in the rise at the 550 ft. north-west level is very hard. I have altered the course of this rise to cut the lode at the nearest point and under the sump-winze. This rise is being driven with all speed, as it is one of the most important points. The north cross-cut at the 400 ft. level is much harder, and letting out a quantity of water, which is a good indication, and I am of opinion we shall cut a lode ore long. There is no alteration in the south cross-cut at the 400 ft. level, and the ground here is favourable for driving. No 1 stop back of the 400 feet level, west of slide, is let on tribute, conditions as follows:—The company to retain 65 per cent. of the proceeds of all ores taken from this stop, after deducting milling charges, &c.; all ores taken from this stop to be milled at the Pacific Company's mills, paying regular price for milling, price to be charged by the superintendent of the above company. The men in five days have broken in this stop about 3 tons of ore, average \$120 per ton. No 2 stop back of the 400 feet level, west of sump-winze, also on tribute, the company retaining 60 per cent. (other conditions as No. 1). The men in this stop have broken about 3 tons of ore, average value \$75 per ton, proceeds of four days' work. No 3 stop back of the 550 ft. level, west of shute, on tribute, the company retaining 65 per cent. (other conditions as No. 1). The men in this stop will commence breaking ore in a day or two; this stop will produce some tons. No 4 stop back of the 350 ft. level, east of shute, on tribute, the company retaining 50 per cent. (other conditions same as No. 1). The men in this stop are breaking some ore worth \$150 per ton. No 5 stop and drift at the 550 feet level, south of sump-shaft, also on tribute, the company to retain 35 per cent. (other conditions as No. 1). This stop is producing rich ore, but the ground is hard and lode rather small. No 6 stop in the 225 feet level, west of sump-shaft, on tribute, the company retaining 50 per cent. (other conditions as No. 1). The men are taking ore from this stop week by week. The United shaft on tribute, the company retaining 40 per cent. (other conditions same as No. 1, except they have to hold their waste). These men are taking out ore, their lode is improving. Chloride shaft, situated near Buel North Star incline, let on tribute, the company retaining 25 per cent. (other conditions as No. 1, except that they have to hold their waste, furnish their tools, timber, and mining supplies); this shaft is producing a small quantity of ore. All contracts with tributers are limited to small portions of ground. The main shaft being vertical, therefore the 400 feet level in reality is about 700 feet from surface, on account of the dip of the lode.

**LAMILLOS.**—June 7: The lode in the 60 fm. level, driving west of San Rafael's shaft, contains stones of ore, but not enough to make a value to the 50, west of San Rafael's shaft, the lode has much improved in the past few days, yielding 1 ton per fathom. The ground is very hard and the lode small in the 50, east of San Magdalena. In the 75, east of Taylor's, there is no improvement, and in the 75, west of the same, the men are put to cross-cut north to get under San Adriano's shaft. The lode in the 50, west of San Yago, is large, with good stones of ore. In the 30, east of San Victor's, the lode is split into several small branches, yielding ¾ ton per fathom. The lode in the 20, east of Addis's, is large and showing symptoms of improvement, yielding ¾ ton per fathom. In the 20, west of the above, the ground is hard and the lode poor. The 40, east of Crosby's is improving, and has a very promising appearance, yielding ¼ ton per fathom. The lode in the 50 of the same is very small in this driving. The lode in the 40, west of Crosby's cross-cut, has diminished in size lately, yielding ¼ ton per fathom. In the 30, east of Henry's shaft, the lode is small and hard for driving, yielding ¼ ton per fathom. The 30, west of the above, being quite poor, is suspended for the present. In the 20, east of Swaffield's, there is no improvement.—Shafts and Winzes: In the 20, east of Swaffield's, below the 40, moderate progress is being made in the sink. The ground is very hard at San Adriano's, below the 60, and the men are getting on slowly. The lode in Martin's winze, below the 50, continues unproductive. In Serrana's winze, below the 50, the lode has diminished in size and value greatly, yielding ¼ ton per fm. Jaen's, below the 40, is going down in a very productive piece of ground, yielding 1½ ton per fathom. The lode at Henry's, below the 20, is small and compact, and the ground hard for sinking, yielding ¾ ton per fathom. The tribute department yielded the same quantity of ore in the past month, and the stopes remain without any change worth of notice. We estimate the raisings for June at 250 tons of ore. The machinery is in very good condition, and the surface operations are going on very regularly.

**FORTUNA.**—June 7: Canada Inco's In the 120, driving west of O'Shea's engine shaft, the ground is hard for driving, and the lode very small. The lode in the 120, east of the same, has increased in size, and has a kindly appearance. In the 110, west of the same, the ground is more favourable for driving than it was. The lode in the 100, west of Henry's, is improving in the end, yielding ¼ ton per fathom. No change worthy of notice has taken place in the 80, south of Henry's cross-cut. The lode in the 60, west of San Pedro, is very large, with good spots of ore, yielding ¾ ton per fathom. The 50, east of the above, is opening fairly productive tribute ground, yielding 1 ton per fathom. At present the lode in the 80, east of Addis's, is quite unproductive. No improvement to notice has taken place in the 80, west of Lowndes'. The lode in the 80, east of the above, is compact, and of a promising appearance, yielding 1 ton per fathom.—Shafts and Winzes: In Carro's shaft, sinking below the 70, the men are making good progress. In Geronamo's winze, below the 30, the lode is drained by the 100, and the sinking resumed; yielding 1½ ton per fm. The water below the 50, in Dolores's winze, is strong, and yields good stones of ore, yielding ¾ ton per fathom. Pedro's winze, below the 50, is of much the same character as the one last described, yielding ¾ ton per fathom.—Los Salidos: In the 110, driving east and west of Buenos Amigos shaft, the men have been, and are, employed about the dividing and casing of the engine-shaft. When this operation is completed the ends will be driven with greater regularity, the latter yielding ¼ ton per fathom. The lode in the 110, of the same, has yielded ¾ ton per fathom. In the 100, west of the above, the ground is very hard, and the lode small for some time past, is improving in the bottom of the end; yielding 1 ton per fathom. In the 75, west of San Carlos, the lode is very small, yielding ¼ ton per fathom. The lode in the 110, east of Morris's engine-shaft, is small,



and the ground very hard for driving. The 100, east of Cox's, has opened a splendid run of ore ground in the past month, and is still rich in back of end; yielding 4 tons per fathom. The lode in the 25, west of Palgrave's, is compact and firm, and of a promising and productive appearance, yielding 3½ tons per fathom. In the 25, east of the above, the lode is small and unproductive at present. Shafts and Winzes: In Palgrave's, sinking below the 25, a new sinking-lift has been fixed in the shaft, and we hope now to make greater dispatch. The ground is very hard for sinking in San Miguel's, below the 75. Pedro's winze, below the 90, is now going down in a very strong and productive lode, yielding 2½ tons per fathom. The lode in Carlos, below the 75, is very compact and regular, yielding 2 tons per fathom. In Jorge's, below the 90, the lode is very firm and well defined, yielding 2 tons per fathom. There was a good average rate of raisings maintained during the past month, and the stopes generally are looking well at present. The machinery is in good condition, and the surface works are going on very regularly. We estimate the returns at 380 tons for June.

**MINAERES.**—Pozo Ancho Mine, June 7: The 85, west of Crosby's shaft, has opened good ore ground in the past month. It is now in contact with a cross-course yielding 1 ton per fathom. In the 75 fm. level of the same, there are stones of ore in the bottom of the end. The lode in the 75, west of San Francisco, is not quite so productive as it was, but we expect it will improve, yielding 1½ ton per fathom. In the driving of the 65, west of San Francisco, the lode is very small, yielding ¼ ton per fathom. The lode in the 55 of the same is very regular, consisting chiefly of quartz, carbonate of zinc, and the same is yielding ½ ton per fathom. In the 45, east of San Francisco, the lode is diminishing in size and value. The lode in the 25 of the same is very small, and of no value. Shafts and Winzes: The lode in the 175 winze, below the 65, is somewhat disarranged at present; we expect an improvement shortly; yielding 1 ton per fathom. The stopes produced the full complement of ore in the past month, and there is no change in the tribute department requiring remark. The surface works and machinery are going on very regularly. We estimate the raisings for June at 200 tons of ore. Quintos Mine: In the 65, east of Taylor's engine shaft, the lode is small, and the granite traversed by strong joints, letting out much water. The ground is hard and the lode very small in the 65, west of the above. The lode in the 55 of the same is improving, and judging from the lode in the level over this, we ought to open good ore ground here, yielding 1½ ton per fathom. In the 55 fathom level, east of Taylor's, the lode is large, with good stones of ore, yielding ½ ton per fathom. The 45 fm. level, west of Cox's, is in contact with the main cross-course, and is suspended for the present. The lode in the 45 fathom level, east of Addis's, is large, consisting of carbonate of lime and good stones of ore, yielding 1 ton per fathom. The 32 fathom level, east of Addis's, is a very wide, strong, and promising lode, yielding 2 tons per fathom. The lode in the 32 fathom level, west of Henty's, is very compact, and opening splendid ore ground, yielding 3 tons per fathom. In the 32, east of the above, the lode is very small and poor. There is no improvement in the 32, west of San Carlos. The lode in the 45 of the same has a promising appearance, yielding ¾ ton per fathom. In the 45, east of San Carlos, the lode is a little more open than it was, and contains good stones of ore, yielding ½ ton per fathom. The 32 of the same is opening fairly productive ground, yielding 1½ ton per fathom. Shafts and Winzes: In San Carlos shaft, below the 45, the men are making fair progress considering the hard nature of the ground. The lode in Rafael's winze below the 45 is open and rich, but does not contain any lead at present. In Martin's winze, below the 32, the lode is improving, this sink yielding 1 ton per fathom. The lode in Grana's, below the 32, is large and strong, with good stones of ore, producing 1 ton per fathom. We are unable to continue the sinking of Carmona's winze below the 55 in consequence of an increase of water.

**RHINE.**—June 13: Schmelzer: Henty's shaft was sunk in the latter half of the month 3 ft. 5 in. The price for the current month is 75 this, per lachter (91.16s. per fathom). The shaft is being sunk by nine men, working three courses of six hours. Six hours out of the twenty-four are devoted to hauling the stuff from the 17 fm. level bargains. Soli Lode: In the 17, driving south, 2 fms. 5 ft. 2 in. was driven last month: present price for driving, by two men and one boy, 14 this, per lachter (86s. per fathom). The lode is more regular than when last reported on; it is composed of killas, with veins of crystallised quartz, carrying a little copper. Schmelzer Lode: In the 17, north-west, 3 fms. 1 ft. 10 in. were driven through a changeable lode, as this lode has hitherto been, but whose character is generally quartzose; it is seldom sprinklings of copper ore. The level driven by six men at 27 this, per lachter (165s. per fathom). The level going south-east on the same lode was driven 4 fms. 0 ft. 8 in.; the lode is composed of soft killas, with facings of carbonate of copper. Stones of galena were met with last week. The lode contains much less blende than formerly; 20 this, per lachter (24.12s. per fathom) is the present price for driving, by six men. Marienfreude: A small adit is being driven through the burrow of the south shaft, to carry off the water from the pump, which will shortly be placed in this shaft. The cross-cut south-east from Maria winze was driven in May 4 fms. 3 ft. 5 in. A small killas lode has been passed through, and a level driven on it for short distance, but it is very small and poor, and not nearly so promising in appearance as it was in the adit level: 2 or 3 fms. have been driven beyond the lode, by way of trial, but nothing of importance has been found. If there be no improvement, these operations will be suspended in a day or two, and the pump placed in the south shaft.

**IMPERIAL OTTOMAN.**—J. B. Champion, June 10: The lode is not intersected in the 25 fm. level. The ground continues to underlie flat, which accounts for the lode being so far from the shaft. The stratum is conglomerate, being composed of pale blue clay, and with branches of friable spar. We are forcing on the driving of the cross-cut as fast as possible, and I hope by the time you receive this to intersect the lode. There is no material alteration in the winze. The lode is composed of blende, iron pyrites, and lead ore. I intend to put some natives with the Cornishmen to drive the cross-cut, and put a full force to resume the sinking of the engine-shaft to another level. The adit driving to intersect the carbonate of lead lode is of a very promising appearance for producing lead ore. We have commenced to dress ore with the fine sieves, which produce a fair quantity of lead, but I have first to teach the natives ere they can properly use them. We have purchased casks to ship the ore at Toulza, and will forward it as soon as possible. Since the above the following Telegram has been received:—"Pera, June 19: Good lode cut at 23 fms., producing lead and copper. Cheering prospects. Particulars by post. Shipment of ore in Swan's hands."

**WEST CANADA.**—Captain F. Williams, May 27: Wellington: At Rowe's shaft, sinking under the 40, the ground still poor; lode yielding about 2 tons per fathom. At the slope, east of Rowe's, the lode is not quite so good as last reported, yielding about 2½ tons per fathom. At the slope, west of ditto, the lode yields 2½ tons per fathom. Huron Copper Bay: Nothing has been done in the 60 west of Palmer's shaft, and the 60 east of Bray's shaft, since last reported; the men have been employed in clearing out ground for the new furnaces, &c. The 50, west of Palmer's shaft, is holed to Stephen's winze, the lode is worth about 1 ton per fathom. At the 35, west of Bray's, or Fere lode, the lode has a promising appearance, and yields 2 tons per fathom. The slope under the 50, west of Palmer's shaft, decreases in value in going westward, now worth 2 tons per fathom. In the slope under the 35, west of ditto, there is an improvement; lode worth 3 tons per fathom. The slope above this level is in a poor bed of ground, but likely to improve; lode yields 2½ tons per fathom. The slope under the 35, east of Bray's shaft, is without change, the lode yielding 2½ tons per fathom. Another slope under this level yields 2½ tons per fathom, and we expect will improve further east.

[For remainder of Foreign Mines see to-day's Journal.]

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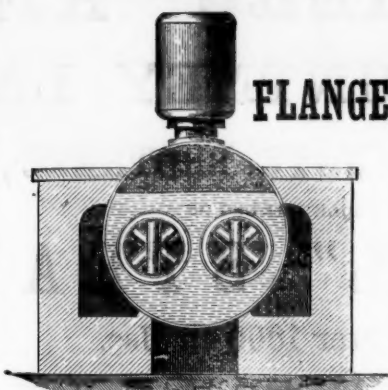
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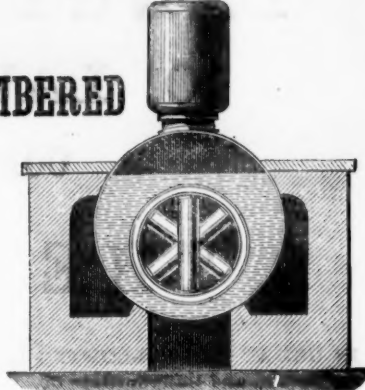
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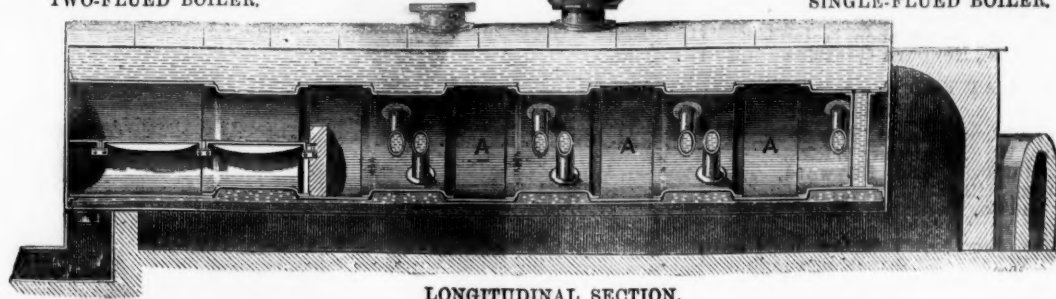
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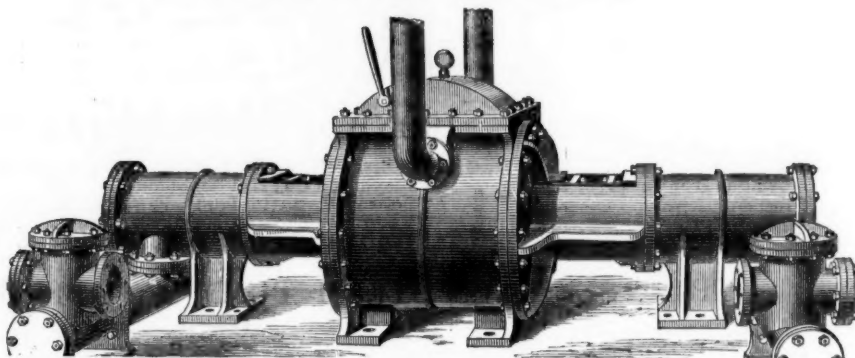
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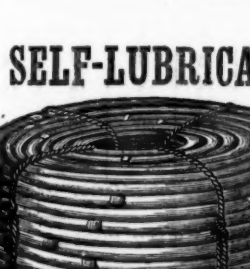
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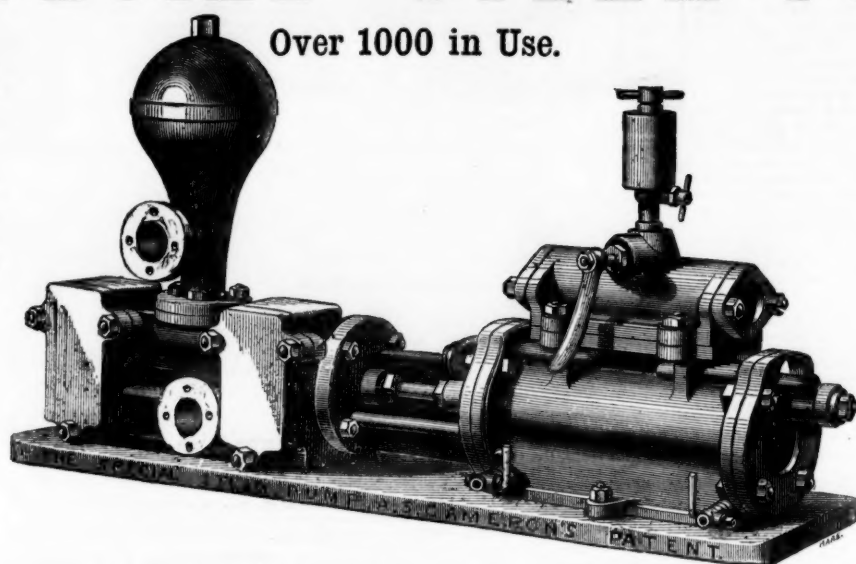
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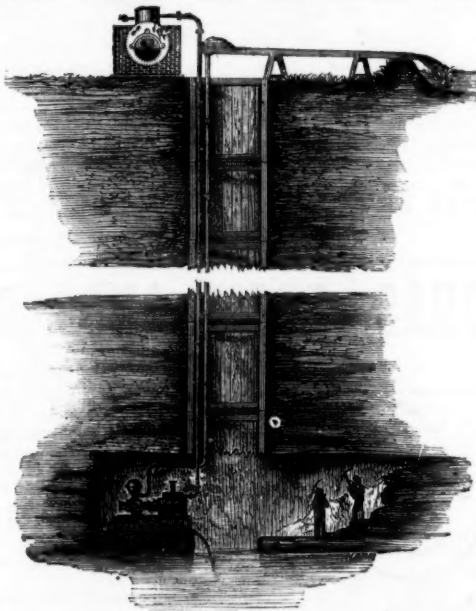
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Bagnall, C. and T., Grosmont Ironworks ...	2 "	Lloyd and Co., Middlesborough ...	1 "	Whessoe Ironworks, Darlington ...	1 "
Consett Ironworks ...	2 "	Solway Hematite Iron Company, Maryport ...	1 "	West Cumberland Hematite Iron Company ...	1 "
Castleford Foundry Company, Normanton ...	1 "	Vaughan, Thomas, Middlesborough ...	2 "	Westbury Iron Company ...	1 "
Ellen Rolling Mills, Maryport ...	1 "	The Shotts Iron Company, Edinburgh ...	1 "		

#### THE "SPECIAL" STEAM PUMP AS APPLIED FOR DRAINING MINES.

The arrangement in the accompanying illustration shows an economical method of draining mines without the expense of erecting surface-engines, fixing pump-rods, or other gearing. A boiler adjacent to the pit's mouth is all that is necessary on the surface; from thence steam may readily be taken down, by means of a felted steam-pipe, to connect the pump with the boiler. The pump may be placed in any situation that may be convenient for working it, and connecting the steam, suction, and delivery pipes.

These engines can be fixed and set to work in a



comparatively short time, and also at a very small outlay. They are used in large mines as auxiliary engines, and will be found invaluable adjuncts in all mining operations.

To estimate the quantity of water to be raised by any given size of pump refer to the tabulated list below. It is recommended to use long-stroke pumps where the height exceeds 100 ft., so that the largest result may be obtained with a minimum wear and tear of the pump pistons and valves. The pumps are provided with doors for ready access to all working parts.

#### PRICES OF THE "SPECIAL" STEAM PUMPS.

Diameter of Steam Cylinder .....	2½	3	4	4	6	6	6	7	7	7	8	8	8	8	10	10	12	12	14	16	26
Diameter of Water Cylinder .....	1½	1½	2	4	3	4	6	5	6	7	4	6	7	8	6	7	8	10	8	7	6½
Length of Stroke .....	6	9	9	12	12	12	12	12	12	12	12	12	12	18	12	12	18	24	48	24	72
Strokes per minute .....	100	100	70	50	50	50	50	50	50	50	50	50	50	35	50	50	35	—	—	—	—
Gallons per hour .....	310	680	815	3250	1830	3250	7330	5070	7330	9750	3250	7330	9750	13,000	7330	9750	13,000	—	—	—	—
PRICE .....	£10	£15	£20	£35	£30	£40	£47 10	£50	£52 10	£57 10	£50	£55	£65	£85	£70	£80	£100	—	—	—	—

IF BRASS LINED, OR SOLID BRASS OR GUN-METAL WATER CYLINDERS, WITH COPPER AIR VESSELS, EXTRA, ACCORDING TO SIZE.

Any Combination can be made between the Steam and Water Cylinders, provided the Lengths of Stroke are the same, thus—8 in. Steam and 3 in. Water, or 10 in. Steam and 3 in. Water, adapted to height of lift and pressure of steam, and so on.

**TANGYE BROTHERS & HOLMAN, 10, Laurence Pountney-lane, London, E.C.**